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Timber resource of Minnesota's northern pine unit, 1977.

Pamela J. Jakes and Gerhard K. Raile

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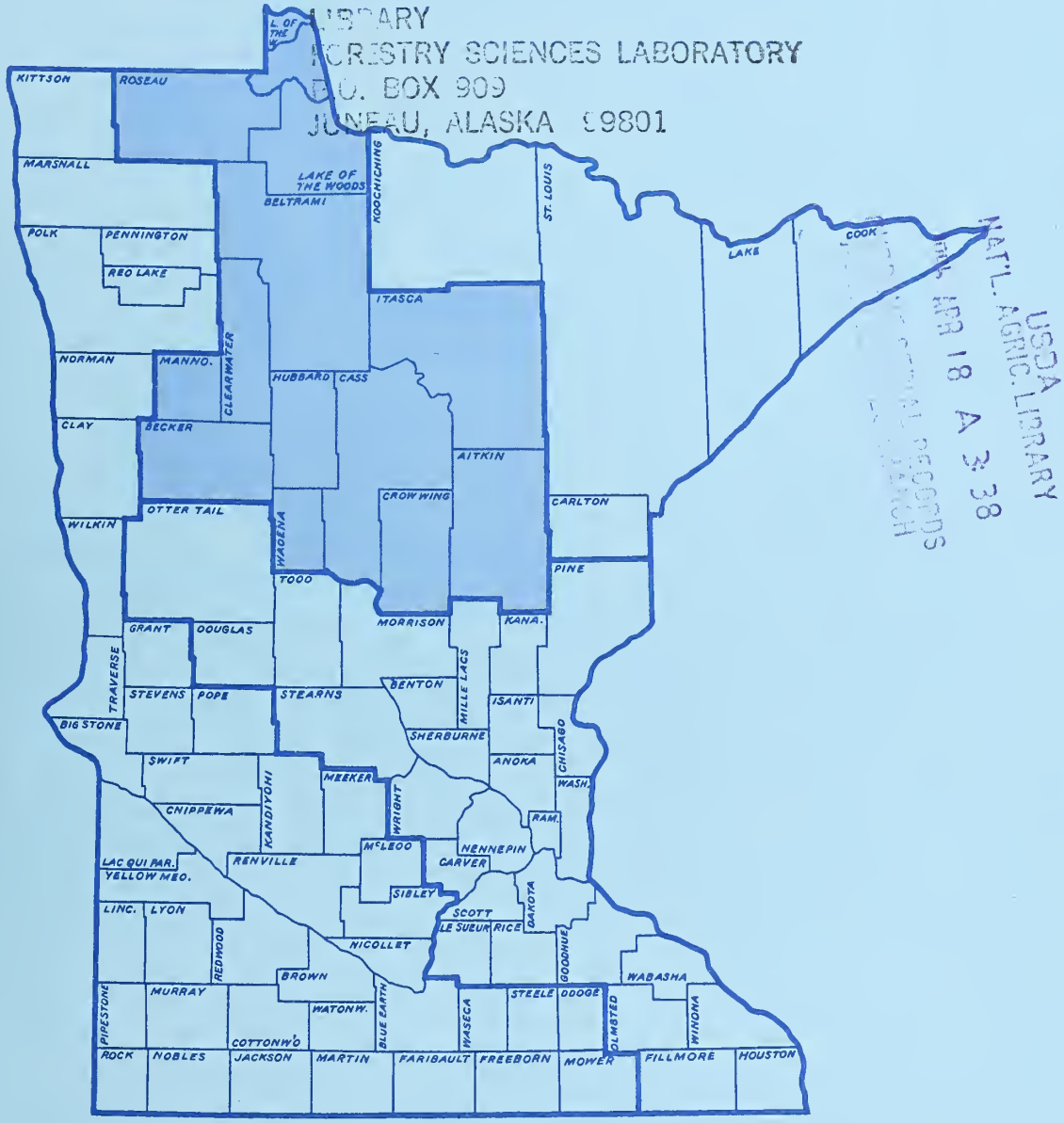

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FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are also available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Northern Pine Unit survey were furnished by the Chippewa National Forest, Minnesota Department of Natural Resources, and the U.S. Department of the Interior, Bureau of Indian Affairs.

TIMBER RESOURCE OF MINNESOTA'S NORTHERN PINE UNIT, 1977

Pamela J. Jakes, *Associate Resource Analyst,*
and **Gerhard K. Raile,** *Associate Mensurationist*

HIGHLIGHTS

Forest Area

- In 1977, 59 percent (6.5 million acres) of the Unit's total land area was classified as forest land; in 1962[1], 63 percent (7.0 million acres) of the Unit's total land area was classified as forest land.
- The area of commercial forest land declined 4 percent between surveys, from 6.0 million acres in 1962 to 5.8 million acres in 1977.
- Fifty-eight percent of the Unit's commercial forest land is publicly owned; the State of Minnesota is the largest public owner (1.2 million acres).
- Farmers own 1.3 million acres of commercial forest land in the Unit, the most of any ownership class (fig. 1).
- The dominant forest type in the Unit is aspen, covering 44 percent of the commercial forest land.
- Poletimber-size stands constitute the largest stand-size class, 53 percent of the commercial forest land is in this class.
- Eleven percent of the Unit's forest land is unproductive.

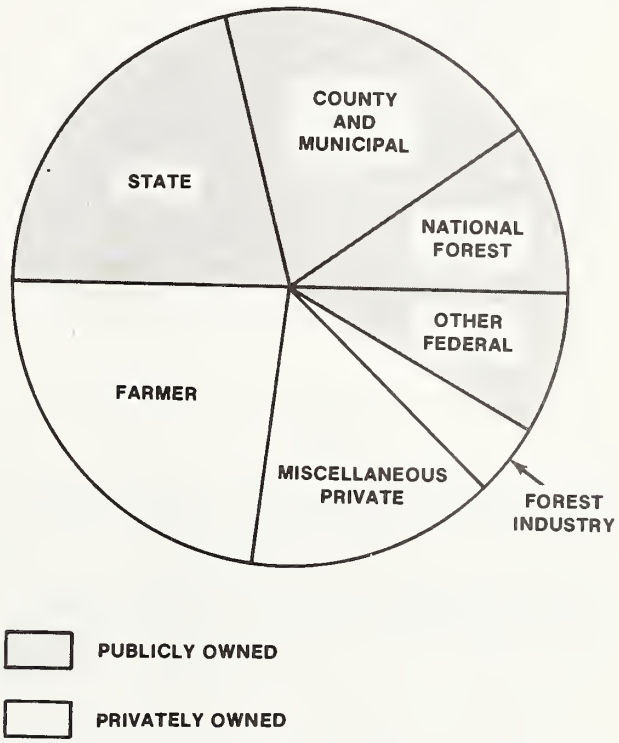

Figure 1.—*Distribution of commercial forest land by ownership class, Northern Pine Unit, Minnesota, 1977.*

Timber Volume

- The net volume of timber on commercial forest land is 5,804 million cubic feet— 87 percent in growing-stock trees, 12 percent in cull trees, and 1 percent in salvable dead trees.
- Growing-stock volume is 5,023 million cubic feet. Sawtimber volume is 10,621 million board feet.

[1]*1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix.)*

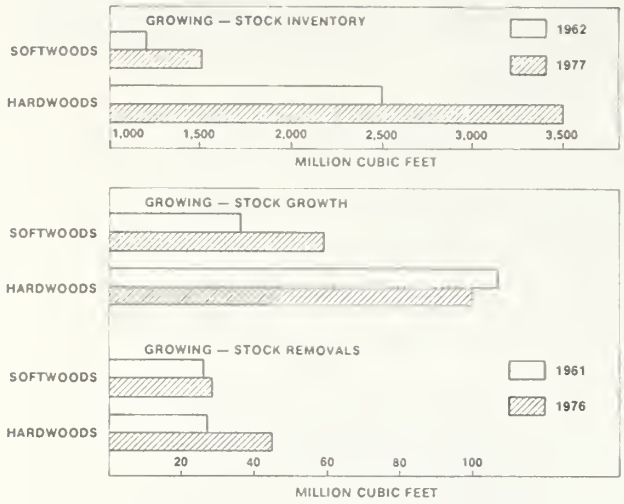

Figure 2.— *Growing-stock inventory, net annual growth, and removals, by softwoods and hardwoods, Northern Pine Unit, Minnesota, 1962 and 1977.*

• Growing-stock volume increased 35 percent between 1962 and 1977 (fig. 2).

• Seventy percent (3,513 million cubic feet) of the growing-stock volume is in hardwood species and 30 percent (1,509 million cubic feet) is in softwoods.

• Sixty-one percent (6,439 million board feet) of the sawtimber volume is in hardwood species and 39 percent (4,182 million board feet) is in softwoods.

• The growing-stock volume per acre of commercial forest land ranges, by county, from a high of 1,013 cubic feet per acre in Itasca County to a low of 518 cubic feet per acre in Roseau County.

• Growing-stock volume is concentrated (47 percent of total volume) in the 8-inch and 10-inch diameter classes.

• Farmers own 22 percent (1,116 million cubic feet) of the Unit's growing-stock volume; county and municipal agencies own 21 percent (1,030 million cubic feet), and the State of Minnesota owns 18 percent (905 million cubic feet).

Stand Condition

• Net annual growth was 159.8 million cubic feet in 1976 or about 28 cubic feet per acre per year.

• The growth rate for softwoods is 3.9 percent of inventory compared to a 2.9 percent growth rate for hardwoods; the growth rate for all tree species is highest on Bureau of Land Management and miscellaneous Federal commercial forest land (4.8 percent of inventory and 4.1 percent of inventory, respectively).

• The mortality rate for softwoods (0.7 percent of inventory) is less than half the mortality rate for hardwoods (1.5 percent).

• Seventy-five percent of the forest stands are more than 30 years old, and 41 percent are more than 50 years old.

Timber Use

• Timber removals in 1976[2] totaled 73.4 million cubic feet— 44.9 million cubic feet from hardwoods and 28.5 million cubic feet from softwoods.

• Three-tenths of total removals came from Itasca County.

• Of the 73.4 million cubic feet of removals, 54.4 million cubic feet were roundwood products, 17.1 million cubic feet were other removals, and 2.0 million cubic feet were logging residue.

• Forty-six percent of removals came from farmer and miscellaneous privately owned land, 22 percent from State-owned land, and 13 percent from county-owned land.

• Timber products output totaled 68.5 million cubic feet in 1975— 59 percent pulpwood, 21 percent saw logs, 13 percent fuelwood, and the remaining 7 percent made up of posts, veneer logs, poles, and other products.

• The volume of primary plant wood residue was 5.4 million cubic feet.

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[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included in 1976 removals.*

TABLES

Area

1. Area of land by land class, 1962 and 1977.
2. Area of land by land class and county.
3. Area of commercial forest land by county and ownership class.
4. Area of commercial forest land by county and forest type.
5. Area of commercial forest land by county and site index class.
6. Area of commercial forest land by county and stand-size class.
7. Area of commercial forest land by site and ownership class.
8. Area of commercial forest land by forest type and ownership class.
9. Area of commercial forest land by forest type and stand-age class.
10. Area of commercial forest land by forest type, stand-size, and site class.
11. Area of noncommercial forest land by ownership class.
12. Area of noncommercial forest land by forest type.

Number of Trees

13. Number of all live trees on commercial forest land by species and diameter class.
14. Number of growing-stock trees on commercial forest land by species and diameter class.
15. Number of short-log trees on commercial forest land by species and diameter class.

Volume

16. Net volume of growing stock and sawtimber on commercial forest land by species, 1962 and 1977.
17. Cubic foot volume in all live trees on commercial forest land by species and diameter class.
18. Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods.
19. Net volume of growing stock on commercial forest land by species and county.
20. Net volume of sawtimber on commercial forest land by species and county.
21. Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species.
22. Net volume of growing stock on commercial forest land by species and diameter class.
23. Net volume of sawtimber on commercial forest land by species and diameter class.
24. Net volume of growing stock on commercial forest land by species and forest type.
25. Net volume of sawtimber on commercial forest land by species and forest type.
26. Net volume of growing stock on commercial forest land by species and ownership class.
27. Net volume of sawtimber on commercial forest land by species and ownership class.
28. Net volume of growing stock on commercial forest land by forest type and stand-age class.
29. Net volume of sawtimber on commercial forest land by forest type and stand-age class.
30. Net volume of short-log trees on commercial forest land by species and diameter class (in cubic feet).
31. Net volume of short-log trees on commercial forest land by species and diameter class (in board feet).

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32. Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, 1961 and 1976.
33. Net annual growth of growing stock on commercial forest land by species and county.
34. Net annual growth of sawtimber on commercial forest land by species and county.
35. Net annual growth of growing stock on commercial forest land by species and ownership class.

36. Net annual growth of sawtimber on commercial forest land by species and ownership class.
37. Net annual growth of growing stock on commercial forest land by species and forest type.
38. Net annual growth of sawtimber on commercial forest land by species and forest type.
39. Net annual growth of growing stock on commercial forest land by forest type and stand-age.
40. Net annual growth of sawtimber on commercial forest land by forest type and stand-age.

Timber removals

41. Timber removals from growing stock and sawtimber on commercial forest land by species, 1962 and 1976.
42. Timber removals from growing stock on commercial forest land by species and county.
43. Timber removals from sawtimber on commercial forest land by species and county.
44. Timber removals from growing stock and sawtimber on commercial forest land by item and species group.
45. Timber removals from growing stock by ownership class and softwoods and hardwoods.
46. Timber removals from sawtimber by ownership class and softwood and hardwoods.

Mortality

47. Annual mortality of growing stock on commercial forest land by species and cause.
48. Annual mortality of sawtimber on commercial forest land by species and cause.
49. Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods.

Utilization

50. Output of timber products by source of material and softwoods and hardwoods.
51. Forest products harvested by ownership class and product.
52. Volume of primary plant residue by kind of material and type of use.
53. Timber products output from roundwood, by species and product.

Text table

54. Sampling errors for estimates smaller than unit totals of volume, net growth, removals, and area of commercial forest land.

PRINCIPAL TREE SPECIES IN MINNESOTA'S NORTHERN PINE UNIT[3]

SOFTWOOD SPECIES

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*

Other softwoods:
Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES

White oaks:
White oak ..... *Quercus alba*
Bur oak ..... *Quercus macrocarpa*

Select red oak:
Northern red oak ..... *Quercus rubra*

Other red oaks:
Northern pin oak ..... *Quercus ellipsoidalis*

Hickories:
Butternut hickory ..... *Carya cordiformis*
Yellow birch ..... *Betula alleghaniensis*

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[3]*The common and scientific names are based on Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

Hard maples:
- Sugar maple ..... *Acer saccharum*

Soft maples:
- Red maple ..... *Acer rubrum*
- Silver maple ..... *Acer saccharinum*

Ashes:
- White ash ..... *Fraxinus americana*
- Black ash ..... *Fraxinus nigra*
- Green ash ..... *Fraxinus pennsylvanica*

Balsam poplar ..... *Populus balsamifera*
Paper birch ..... *Betula papyrifera*
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Basswood ..... *Tilia americana*

Elms:
- American elm ..... *Ulmus americana*
- Slippery elm ..... *Ulmus rubra*
- Rock elm ..... *Ulmus thomasii*

Select hardwoods:
- Butternut ..... *Juglans cinerea*
- Black cherry ..... *Prunus serotina*

Other hardwoods:
- Boxelder ..... *Acer negundo*
- Eastern cottonwood ..... *Populus deltoides*
- Black willow ..... *Salix nigra*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Northern Pine Unit in 1977, 5,758.4 thousand acres, has a sampling error of ±0.69 percent (±39.7 thousand acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would fall between 5,798.1 and 5,718.7 thousand acres (5,758.4 ±39.7).

Sampling errors were calculated separately for National Forest land and other land, reflecting the higher sampling intensity on other land. For example, the sampling error for growing-stock inventory on National Forest land is ±7.47, but on other land it is ±1.18.

The following sampling errors are the combined sampling errors for total estimated volume, net growth, and removals, and area of commercial forest land during the 1977 Northern Pine Unit survey

Item	Northern pine unit totals	Sampling error (percent)	
Growing stock:			
Volume	5,022.9	MM cubic feet	1.40
Growth	159.8	MM cubic feet	1.80
Removals	73.4	MM cubic feet	5.34
Sawtimber:			
Volume	10,620.7	MM board feet	2.94
Growth	488.1	MM board feet	2.95
Removal	182.4	MM board feet	4.30
Commercial forest land:	5,758.4	M acres	0.69

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURES

The major steps in the survey of the Northern Pine Unit were as follows:

1. A total of 72,591 1-acre points were distributed systematically across aerial photos of the entire area, except the Chippewa National Forest. To make a preliminary estimate of forest area, these points were classified as either forest land (31,050), unproductive forest land (2,223), nonforest land (38,702), or questionable (616). Next, all 31,050 of the forest points, 298 of the unproductive forest points, 47 of the nonforest points with trees, and all 616 of the questionable points were stereoclassified as to forest type, stand-size class, and density. Then, 4,202 points classed as forest, 298 points classed as unproductive, and 81 points classed as questionable were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 3,718 commercial forest locations, 10-point variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated using the Forest Resources Evaluation Program (FREP)[4], which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

3. Area statistics for the Chippewa National Forest were prepared by the Forest Timber Management staff from compartment examination records. In 1975, the Forest conducted its own forest inventory using 10-point variable-radius plots established by Forest personnel under the direction of the North Central Station. Data from these plots were used as input for FREP, which, was used to update volumes to 1977. The updated Chippewa National Forest data were approved by the Forest and merged with Survey data from non-National Forest commercial forest land to estimate volume, growth, and mortality for the Unit.

4. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

5. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

6. Field data were sent to St. Paul, Minnesota, for compilation.

COMPARING MINNESOTA'S FOURTH SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

[4] *For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. NC-49, 96 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

In Minnesota's Northern Pine Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys. Then, a portion of the 1962 commercial forest area was withdrawn and added to unproductive forest (noncommercial) and to nonforest to allow for changes in the method of determining these land uses. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area. However, because the 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes. Volume adjustments were made by estimating inventory, growth, mortality, and removals on the unproductive forest and nonforest lands originally classed as commercial forest in 1962, and subtracting these volumes from the original State 1962 estimates.

A test was made to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so that changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commerical forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys reflected actual change and not merely a change in the volume equations used on each occasion.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals and are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included. Previously published 1960 estimates are of timber cut only and do not include "other" removals. TRAS generated an estimate of 1962 "other" removals to provide the adjusted 1962 total removals.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-Use Classes

Gross area.— The entire area of land and water as determined by the Bureau of Census, 1960.

Land area.— The area of dry land and land temporarily or partially covered by water such as

marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than 1/8-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.— Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.— Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.— (a) Unproductive— forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved— forest land withdrawn from commercial timber use through statute or administrative regulation or exclusively used for Christmas tree production.

Nonforest land.— Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased. —Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.— Land owned by a private individual but leased to another party.

Tree Classes

All live trees.— Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.— All live trees of commercial species except rough and rotten trees.

Desirable trees.— Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.— Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.— Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.— Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.— Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.— Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more than 6 inches and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.— Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.— Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).— Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.— Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.— Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.— Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands.— Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.— Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-Size Classes

Stand.— A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.— Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.— Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.— Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.— Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.— An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.— A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.— Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.— The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are

Jack pine.— Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.— Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.— Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.— Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.— Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.— Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of the live-tree stocking, with black spruce the most common.

Northern white-cedar.— Forests in which swamp conifers comprise a plurality of the live-tree stocking, with northern white-cedar the most common.

Tamarack.— Forests in which swamp conifers comprise a plurality of live-tree stocking, with tamarack the most common.

Oak.— Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.— Forests in which lowland elm, ash, cottonwood and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.— Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.— Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.— Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.— Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.— The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.— Net volume of the saw log portion of live sawtimber trees in board

feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.— That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.— Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year,

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

The annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year, and

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Timber Removals

Timber removals from growing stock.— The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees

removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change— examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.— The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.— All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.— Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.— Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Northern Pine Unit, Minnesota, 1962 and 1977*
(In thousand acres)

Land class	[1]1962	1977
Commercial forest land:		
Jack pine	453.1	327.4
Red pine	149.5	121.9
White pine	40.2	24.8
Balsam fir	231.0	225.6
White spruce	5.6	19.1
Black spruce	303.7	278.2
Northern white-cedar	120.7	180.8
Tamarack	250.1	276.0
Oak	360.9	247.4
Elm-ash-cottonwood	397.4	309.8
Maple-basswood	421.0	466.4
Aspen	2,360.8	2,541.7
Paper birch	283.4	371.2
Balsam poplar	240.3	297.5
Nonstocked	407.3	70.6
Subtotal	6,025.0	5,758.4
Noncommercial forest land:		
Unproductive	950.1	706.9
Productive-reserved	29.1	46.9
Subtotal	979.2	753.8
Nonforest land:	4,133.1	4,542.9
Total	11,137.3	11,055.1

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 areas because of changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Land class	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Forest land:													
Commercial	5,758.4	672.5	313.9	794.6	858.6	301.7	371.9	398.0	1,281.0	360.6	106.4	191.9	107.3
Productive-reserved	46.9	15.0	3.1	0.5	1.3	19.6	—	4.0	1.5	—	—	1.9	—
Unproductive	706.9	75.1	5.8	248.9	23.5	12.4	8.8	1.2	49.1	235.5	1.4	38.8	6.4
Total forest	6,512.2	762.6	322.8	1,044.0	883.4	333.7	380.7	403.2	1,331.6	596.1	107.8	232.6	113.7
Nonforest with trees:													
Cropland with trees	20.8	1.5	6.3	1.7	—	—	—	1.8	1.6	1.6	3.2	1.6	1.5
Improved pasture with trees	29.4	4.7	4.1	2.7	5.5	2.9	—	—	3.2	—	—	3.3	3.0
Wooded strips	24.6	4.0	2.9	1.4	2.4	4.2	2.3	—	5.8	—	—	1.6	—
Idle farmland with trees	1.4	—	—	1.4	—	—	—	—	—	—	—	—	—
Windbreaks	12.3	—	1.1	1.6	—	5.0	—	1.6	—	1.2	—	1.8	—
Wooded pasture	22.1	1.3	2.7	5.6	1.7	1.6	4.8	3.1	1.3	—	—	—	—
Total nonforest with trees	110.6	11.5	17.1	14.4	9.6	13.7	7.1	6.5	11.9	2.8	3.2	8.3	4.5
Nonforest without trees:													
Cropland without trees	2,007.2	96.6	323.4	149.8	101.1	148.4	68.5	131.6	74.2	84.0	173.6	527.2	128.8
Improved pasture without trees	527.3	45.0	56.2	76.2	87.4	13.1	46.3	4.2	37.8	15.4	36.4	77.3	42.0
Idle farmland without trees	22.3	1.4	1.4	7.3	—	3.0	1.7	—	3.1	—	—	4.4	—
Marsh	1,449.9	218.0	76.6	277.7	155.1	102.3	76.1	26.0	123.7	138.9	26.6	190.7	38.2
Other farm-farmstead	43.3	1.4	6.8	4.2	4.3	2.8	1.4	—	9.8	1.4	2.8	5.6	2.8
Urban and other	350.2	31.6	32.0	30.6	37.9	18.2	47.7	22.3	82.1	0.2	8.2	26.7	12.7
Noncensus water	32.1	1.6	3.7	—	—	4.7	7.0	2.4	11.1	—	1.6	—	—
Total nonforest without trees	4,432.3	395.6	490.1	545.8	385.8	292.5	248.7	186.5	341.8	239.9	249.2	831.9	224.5
Total nonforest	4,542.9	407.1	507.2	560.2	395.4	306.2	255.8	193.0	353.7	242.7	252.4	840.2	229.0
Total land area[1]	11,055.1	1,169.7	830.0	1,604.2	1,278.8	639.9	636.5	596.2	1,685.3	838.8	360.2	1,072.8	342.7
Census water	1,437.7	103.3	84.6	351.0	244.4	19.3	95.0	41.2	170.7	308.7	15.5	0.5	3.5
Total gross area	12,492.8	1,273.0	914.6	1,955.2	1,523.2	659.2	731.5	637.4	1,856.0	1,147.5	375.7	1,073.3	346.2

[1]U.S. Department of Commerce, Bureau of Census. Area measurement reports, GE-20 No. 1, 22 p., 1970.

Table 3.—*Area of commercial forest land by county and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

		Ownership class												
County	All owners	National forest	Bureau of Land Management	Indian	Misc. federal	State	County and municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Aitkin	672.5	—	—	—	8.3	217.4	180.0	4.2	180.8	—	5.2	76.6	—	—
Becker	313.9	—	—	3.9	23.3	36.6	64.2	2.6	138.0	—	1.4	41.2	—	2.7
Beltrami	794.6	54.7	—	195.6	—	227.2	133.7	2.5	137.4	—	—	43.5	—	—
Cass	858.6	242.7	—	11.4	—	121.0	211.1	28.1	119.1	—	13.8	111.4	—	—
Clearwater	301.7	—	—	56.4	—	26.2	63.6	5.5	136.1	—	—	13.9	—	—
Crow Wing	371.9	—	—	—	—	16.9	74.3	18.3	68.9	—	35.8	157.7	—	—
Hubbard	398.0	—	1.4	—	—	64.4	128.4	20.9	122.1	—	6.0	54.8	—	—
Itasca	1,281.0	264.9	—	1.5	—	233.6	235.9	131.3	206.9	—	85.3	121.6	—	—
Lake of the Woods	360.6	—	34.4	63.1	2.9	171.9	—	1.6	49.2	—	—	37.5	—	—
Mahnomen	106.4	—	—	28.7	—	21.3	4.2	—	50.8	—	—	1.4	—	—
Roseau	191.9	—	—	4.3	26.0	75.0	1.3	—	61.3	—	4.2	19.8	—	—
Wadena	107.3	—	—	—	—	17.2	—	18.8	51.5	—	2.6	17.2	—	—
All counties	5,758.4	562.3	35.8	364.9	60.5	1,228.7	1,096.7	233.8	1,322.1	—	154.3	696.6	—	2.7

Table 4.—*Area of commercial forest land by county and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

County	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Aitkin	672.5	2.5	1.6	1.2	15.2	1.2	50.0	8.2	43.4	15.4	71.2	142.8	253.4	40.2	23.4	2.8
Becker	313.9	16.7	2.6	1.1	10.5	—	6.1	—	17.4	29.4	8.8	41.1	151.8	20.3	8.1	—
Beltrami	794.6	40.1	15.7	7.1	26.3	4.1	34.5	53.1	63.5	8.6	47.6	40.8	319.3	48.5	70.5	14.9
Cass	858.6	55.3	35.4	6.9	19.9	1.4	17.7	25.4	23.4	49.1	36.0	66.1	423.0	80.7	12.8	5.5
Clearwater	301.7	7.7	4.9	4.4	15.6	—	8.6	4.6	13.4	7.2	9.9	29.6	156.3	15.8	22.0	1.7
Crow Wing	371.9	25.4	4.1	—	2.8	—	4.2	1.2	12.0	86.7	18.5	19.6	165.9	29.0	—	2.5
Hubbard	398.0	63.5	12.9	1.4	14.1	3.3	5.9	1.4	6.5	17.3	2.5	5.7	224.9	30.2	8.4	—
Itasca	1,281.0	40.6	39.8	2.7	97.2	4.9	84.7	60.1	43.3	9.9	89.2	96.7	539.7	92.0	56.6	23.6
Lake of the Woods	360.6	22.6	1.4	—	16.5	2.7	54.9	21.2	33.6	—	7.8	—	115.1	10.2	57.8	16.8
Mahnomen	106.4	1.4	—	—	1.7	1.5	—	—	2.6	9.7	1.7	17.0	64.7	3.0	3.1	—
Roseau	191.9	15.0	—	—	5.8	—	9.2	5.6	15.0	—	13.9	5.8	85.9	1.3	31.6	2.8
Wadena	107.3	36.6	3.5	—	—	—	2.4	—	1.9	14.1	2.7	1.2	41.7	—	3.2	—
All counties	5,758.4	327.4	121.9	24.8	225.6	19.1	278.2	180.8	276.0	247.4	309.8	466.4	2,541.7	371.2	297.5	70.6

Table 5.—*Area of commercial forest land by county and site index class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

County	All classes	Site index class (cubic feet of growth/acre/year)							
		91+	81-90	71-80	61-70	51-60	41-50	31-40	21-30	11-20
Aitkin	672.5	4.0	34.6	108.9	165.4	166.2	99.9	58.9	33.5	1.1
Becker	313.9	—	9.3	44.2	91.5	82.2	45.6	38.2	2.9	—
Beltrami	794.6	7.1	38.6	127.6	182.5	164.4	101.1	98.5	63.5	11.3
Cass	858.6	1.4	70.1	193.5	217.0	196.7	96.6	51.0	27.7	4.6
Clearwater	301.7	8.4	26.3	40.0	79.9	67.9	45.1	23.2	9.5	1.4
Crow Wing	371.9	—	15.1	58.8	103.5	116.0	64.8	6.7	7.0	—
Hubbard	398.0	—	19.6	58.4	121.9	109.9	63.5	18.6	6.1	—
Itasca	1,281.0	19.4	159.8	264.1	283.5	212.6	134.5	106.8	83.6	16.7
Lake of the Woods	360.6	—	5.4	23.7	51.8	70.3	85.0	61.6	49.5	13.3
Mahnomen	106.4	1.4	2.8	25.7	25.8	26.5	16.8	7.4	—	—
Roseau	191.9	—	1.3	5.2	33.5	53.8	59.5	29.6	9.0	—
Wadena	107.3	—	—	10.1	32.9	33.2	15.6	12.4	3.1	—
All counties	5,758.4	41.7	382.9	960.2	1,389.2	1,299.7	828.0	512.9	295.4	48.4

Table 6.—*Area of commercial forest land by county and stand-size class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

County	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Aitkin	672.5	142.0	331.1	196.6	2.8
Becker	313.9	81.1	178.9	53.9	—
Beltrami	794.6	154.8	428.6	196.3	14.9
Cass	858.6	189.0	515.3	148.8	5.5
Clearwater	301.7	77.5	150.4	72.1	1.7
Crow Wing	371.9	81.7	223.4	64.3	2.5
Hubbard	398.0	71.5	242.8	83.7	—
Itasca	1,281.0	308.5	677.2	271.7	23.6
Lake of the Woods	360.6	49.6	144.9	149.3	16.8
Mahnomen	106.4	22.4	56.5	27.5	—
Roseau	191.9	29.7	72.3	87.1	2.8
Wadena	107.3	18.0	61.1	28.2	—
All counties	5,758.4	1,225.8	3,082.5	1,379.5	70.6

Table 7.—*Area of commercial forest land by site and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-225	120-165	85-120	50-85	20-50
National forest	562.3	—	—	1.5	162.5	175.2	223.1
Bureau of Land Mgmt.	35.8	—	—	—	2.8	13.5	19.5
Indian	364.9	—	1.4	5.9	61.6	118.3	177.7
Miscellaneous federal	60.5	—	—	—	1.3	25.8	33.4
State	1,228.7	—	—	10.6	196.5	363.3	658.3
County and municipal	1,096.7	—	—	18.9	255.6	467.6	354.6
Forest industry	233.8	—	1.2	3.9	74.7	64.9	89.1
Farmer	1,322.1	—	—	23.7	227.3	551.9	519.2
Farmer-owned Leased	—	—	—	—	—	—	—
Misc. private-corp.	154.3	—	—	2.6	41.7	67.6	42.4
Misc. private-individual	696.6	—	—	5.5	133.1	260.9	297.1
Misc. priv.-corp., leased	—	—	—	—	—	—	—
Misc. priv.-ind., leased	2.7	—	—	—	—	1.4	1.3
All owners	5,758.4	—	2.6	72.6	1,157.1	2,110.4	2,415.7

Table 8.—*Area of commercial forest land by ownership class and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
National forest	562.3	28.0	57.4	4.4	40.7	2.3	31.4	12.7	7.2	11.1	38.8	58.9	206.9	49.3	—	13.2
Bureau of Land Management	35.8	6.7	1.4	—	—	1.4	3.0	4.8	—	—	1.6	—	12.5	—	2.8	1.6
Indian	364.9	5.2	6.3	7.5	8.5	4.1	38.1	37.2	25.5	7.2	11.7	19.2	156.2	14.6	20.3	3.3
Miscellaneous federal	60.5	2.5	1.3	—	3.2	—	1.6	1.6	5.6	4.0	1.0	7.3	19.7	5.9	5.3	1.5
State	1,228.7	61.3	13.3	1.2	61.7	4.1	123.1	75.1	128.1	19.4	55.0	63.0	443.9	57.6	89.6	32.3
County and municipal	1,096.7	61.9	12.4	1.4	53.8	4.1	37.0	20.2	43.7	32.6	47.5	86.8	560.5	93.2	38.6	3.0
Forest industry	233.8	40.5	9.1	—	8.5	—	6.7	1.5	2.7	7.6	13.0	19.7	105.1	8.9	6.8	3.7
Farmer	1,322.1	74.2	14.1	8.9	35.5	3.1	27.6	17.1	38.6	88.8	92.9	131.7	620.7	76.7	86.5	5.7
Farmer-owned leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private-corp.	154.3	7.1	—	—	1.3	—	3.1	—	10.4	12.0	5.7	14.0	84.1	9.2	7.4	—
Misc. private-individual	696.6	40.0	6.6	1.4	12.4	—	6.6	10.6	14.2	63.4	42.6	65.8	330.7	55.8	40.2	6.3
Misc. private corp., leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private ind., leased	2.7	—	—	—	—	—	—	—	—	1.3	—	—	1.4	—	—	—
All owners	5,758.4	327.4	121.9	24.8	225.6	19.1	278.2	180.8	276.0	247.4	309.8	466.4	2,541.7	371.2	297.5	70.6

Table 9.—*Area of commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Forest type	All ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	140 & over
Jack pine	327.4	9.2	17.6	35.6	79.2	83.3	67.2	27.7	6.5	—	1.1	—	—	—
Red pine	121.9	8.7	3.3	5.1	5.2	9.1	5.1	10.3	39.5	1.4	32.8	1.4	—	—
White pine	24.8	—	—	—	1.3	6.8	2.8	3.0	2.5	1.4	2.6	4.4	—	—
Balsam fir	225.6	11.7	22.0	26.5	17.8	41.4	34.2	58.1	10.9	1.6	—	1.4	—	—
White spruce	19.1	1.4	1.1	3.4	—	—	9.4	2.6	—	1.2	—	—	—	—
Black spruce	278.2	20.6	29.1	53.6	58.0	22.3	30.2	19.5	10.7	22.9	4.0	4.4	2.9	—
Northern white-cedar	180.8	1.6	2.7	8.2	4.1	4.3	18.1	29.4	16.2	22.3	12.4	27.4	30.0	4.1
Tamarack	276.0	18.0	38.7	25.1	16.3	16.3	49.2	12.2	22.4	25.9	6.0	26.0	19.9	—
Oak	247.4	13.2	15.9	7.9	27.9	55.3	46.9	30.8	25.5	7.0	9.6	7.4	—	—
Elm-ash-cottonwood	309.8	14.9	17.7	23.6	16.4	21.4	48.7	33.8	33.4	41.7	34.5	16.9	6.8	—
Maple-basswood	466.4	6.7	13.9	13.7	40.8	95.7	106.1	61.0	46.1	20.3	34.8	7.6	19.7	—
Aspen	2,541.7	290.7	246.3	212.4	446.6	653.1	442.0	164.5	52.5	22.4	6.7	3.1	1.4	—
Paper birch	371.2	5.2	11.9	11.2	46.0	105.2	100.5	52.6	17.8	12.2	4.5	4.1	—	—
Balsam poplar	297.5	35.9	53.4	29.0	47.5	57.6	38.3	21.6	12.8	1.4	—	—	—	—
Nonstocked	70.6	69.1	—	—	—	1.5	—	—	—	—	—	—	—	—
All types	5,758.4	506.9	473.6	455.3	807.1	1,173.3	998.7	527.1	296.8	181.7	149.0	104.1	80.7	4.1

Table 10.—*Area of commercial forest land by forest type, stand-size class, and site class, Northern Pine Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class (cubic feet of growth/acre/year) 165 or more	120-165	85-120	50-85	Less than 50
Jack pine						
Sawtimber	105.9	—	1.4	2.4	51.9	50.2
Poletimber	174.6	—	—	8.3	86.1	80.2
Sapling & seedling	46.9	—	—	—	15.9	31.0
All stands	327.4	—	1.4	10.7	153.9	161.4
Red pine						
Sawtimber	94.3	—	—	40.7	45.1	8.5
Poletimber	15.6	—	2.1	6.8	2.7	4.0
Sapling & seedling	12.0	—	—	6.1	4.0	1.9
All stands	121.9	—	2.1	53.6	51.8	14.4
White pine						
Sawtimber	20.9	1.4	5.6	13.9	—	—
Poletimber	3.9	—	—	3.9	—	—
Sapling & seedling	—	—	—	—	—	—
All stands	24.8	1.4	5.6	17.8	—	—
Balsam fir						
Sawtimber	31.6	—	9.6	12.2	6.8	3.0
Poletimber	124.4	1.2	10.9	44.8	25.0	42.5
Sapling & seedling	69.6	—	4.1	15.8	16.3	33.4
All stands	225.6	1.2	24.6	72.8	48.1	78.9
White spruce						
Sawtimber	8.7	—	—	1.2	7.5	—
Poletimber	6.4	—	—	—	4.5	1.9
Sapling & seedling	4.0	—	—	—	2.6	1.4
All stands	19.1	—	—	1.2	14.6	3.3
Black spruce						
Sawtimber	7.1	—	—	—	—	7.1
Poletimber	80.8	—	—	1.6	1.5	77.7
Sapling & seedling	190.3	—	—	—	6.9	183.4
All stands	278.2	—	—	1.6	8.4	268.2
Northern white-cedar						
Sawtimber	35.3	—	—	—	—	35.3
Poletimber	122.5	—	—	—	6.4	116.1
Sapling & seedling	23.0	—	—	—	—	23.0
All stands	180.8	—	—	—	6.4	174.4
Tamarack						
Sawtimber	26.1	—	—	1.3	7.4	17.4
Poletimber	132.2	—	—	—	21.0	111.2
Sapling & seedling	117.7	—	—	—	9.6	108.1
All stands	276.0	—	—	1.3	38.0	236.7
Oak						
Sawtimber	65.5	—	—	2.8	14.4	48.3
Poletimber	143.5	—	—	5.5	48.1	89.9
Sapling & seedling	38.4	—	—	—	9.1	29.3
All stands	247.4	—	—	8.3	71.6	167.5
Elm-ash-cottonwood						
Sawtimber	76.4	—	—	—	10.5	65.9
Poletimber	169.5	—	—	1.1	14.3	154.1
Sapling & seedling	63.9	—	—	—	—	63.9
All stands	309.8	—	—	1.1	24.8	283.9
Maple-basswood						
Sawtimber	179.0	—	—	10.2	60.5	108.3
Poletimber	252.9	—	—	21.8	75.7	155.4
Sapling & seedling	34.5	—	—	—	4.4	30.1
All stands	466.4	—	—	32.0	140.6	293.8
Aspen						
Sawtimber	452.4	—	8.7	184.5	213.8	35.4
Poletimber	1,451.4	—	8.8	607.4	697.0	128.2
Sapling & seedling	637.9	—	—	120.8	351.0	166.1
All stands	2,541.7	—	7.5	912.7	261.8	329.7
Paper birch						
Sawtimber	55.9	—	—	1.4	25.0	29.5
Poletimber	288.3	—	1.4	6.7	92.3	187.9
Sapling & seedling	27.0	—	—	1.3	11.2	14.5
All stands	371.2	—	1.4	9.4	128.5	231.9
Balsam poplar						
Sawtimber	66.7	—	—	10.1	41.3	15.3
Poletimber	116.5	—	—	18.7	52.6	45.2
Sapling & seedling	114.3	—	—	4.6	56.0	53.7
All stands	297.5	—	—	33.4	149.9	114.2
Nonstocked	70.6	—	—	1.2	12.0	57.4
All types	5,758.4	2.6	72.6	1,157.1	2,110.4	2,415.7

Table 11.—*Area of noncommercial forest land by ownership class, Northern Pine Unit, Minnesota, 1977*

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National forest	28.2	1.9	26.3
Other federal	70.8	1.7	69.1
State, county, and municipal	584.4	43.3	541.1
Forest industry	4.3	—	4.3
Farmer	53.8	—	53.8
Miscellaneous private	12.3	—	12.3
All ownerships	753.8	46.9	706.9

Table 12.—*Area of noncommercial forest land by forest type, Northern Pine Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Jack pine	4.3	2.7	1.6
Red-white pine	6.7	6.7	—
Spruce-fir	15.5	1.4	14.1
Black spruce	382.6	5.8	376.8
Northern white-cedar	43.8	0.2	43.6
Tamarack	69.8	0.2	69.6
Oak	10.7	—	10.7
Elm-ash-cottonwood	132.9	4.2	128.7
Maple-basswood	7.5	5.5	2.0
Aspen-birch	80.0	20.2	59.8
Nonstocked	—	—	—
All forest types	753.8	46.9	706.9

Table 13.—*Number of all live trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (Inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	14,102	3,457	3,641	2,645	947	1,224	381	464	487	375	117	143	205	13	3
Red pine	31,668	8,737	6,594	3,629	4,097	2,147	1,554	1,432	1,513	1,093	378	366	124	4	—
Jack pine	140,162	33,999	39,097	30,714	21,249	9,438	3,908	1,277	382	78	11	8	1	—	—
White spruce	23,804	11,044	6,411	3,291	1,271	769	466	249	148	83	45	18	9	—	—
Black spruce	237,495	116,930	80,809	29,509	8,159	1,769	235	50	22	4	8	—	—	—	—
Balsam fir	299,932	160,104	70,255	40,960	18,619	6,848	2,269	589	191	92	2	3	—	—	—
Tamarack	127,461	47,342	36,801	28,923	10,012	3,262	892	168	43	13	3	—	2	—	—
Northern white-cedar	109,748	30,714	24,919	27,987	14,430	6,797	3,103	1,117	432	156	62	23	8	—	—
Other softwoods	262	—	—	189	24	21	12	9	4	—	3	—	—	—	—
Total softwoods	984,634	412,327	268,527	167,847	78,808	32,275	12,820	5,355	3,222	1,894	629	561	349	17	3
Hardwoods:															
Select white oaks	110,201	51,668	29,967	14,681	6,909	3,356	1,880	865	441	230	103	57	41	3	—
Select red oaks	72,256	17,228	13,956	15,714	12,053	6,802	3,480	1,710	730	311	169	63	37	3	—
Other red oaks	798	378	138	157	69	41	8	4	—	3	—	—	—	—	—
Hickory	198	—	123	—	57	10	8	—	—	—	—	—	—	—	—
Yellow birch	4,147	2,089	762	610	262	133	103	114	30	22	7	8	6	1	—
Hard maple	147,326	87,570	35,534	12,503	4,927	3,287	1,518	1,063	573	224	81	30	14	2	—
Soft maple	114,274	61,152	30,776	13,737	5,507	1,704	647	295	225	112	54	27	28	10	—
Ash	252,341	143,067	56,172	28,103	14,155	6,723	2,597	943	393	116	58	7	7	—	—
Balsam poplar	161,304	79,396	34,459	21,045	13,083	7,009	3,783	1,621	642	176	58	11	21	—	—
Paper birch	263,090	74,238	70,902	63,973	32,431	14,010	5,063	1,785	488	132	45	16	7	—	—
Bigtooth aspen	32,723	9,408	5,521	5,153	5,684	3,909	1,815	787	290	109	35	10	2	—	—
Quaking aspen	777,819	375,357	136,472	98,444	76,565	50,614	24,766	9,892	3,732	1,370	400	159	47	1	—
Basswood	94,858	35,572	21,291	16,280	10,479	6,138	2,848	1,244	552	258	103	54	37	2	—
Elm	89,724	40,406	19,311	12,343	8,050	4,356	2,283	1,332	722	466	210	127	100	18	—
Select hardwoods	6,329	3,313	2,050	599	253	79	22	5	7	—	—	—	1	—	—
Other hardwoods	5,232	2,903	1,341	547	247	86	44	24	17	3	12	4	4	—	—
Noncommercial species	76,332	65,747	8,229	1,981	239	80	44	—	8	—	4	—	—	—	—
Total hardwoods	2,208,952	1,049,492	467,004	305,870	190,970	108,337	50,909	21,684	8,850	3,532	1,339	573	352	40	—
All species	3,193,586	1,461,819	735,531	473,717	269,778	140,612	63,729	27,039	12,072	5,426	1,968	1,134	701	57	3

Table 14.—*Number of growing-stock trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	11,705	2,647	3,059	2,083	738	1,195	360	441	366	369	116	131	187	10	3
Red pine	29,529	7,105	6,594	3,282	4,008	2,105	1,548	1,419	1,515	1,088	373	365	124	3	—
Jack pine	116,948	23,269	31,940	27,698	19,825	8,992	3,676	1,142	319	72	6	8	1	—	—
White spruce	21,289	8,956	6,276	3,113	1,223	716	453	249	148	83	45	18	9	—	—
Black spruce	177,347	75,479	66,682	25,502	7,748	1,637	220	49	18	4	8	—	—	—	—
Balsam fir	258,386	128,124	65,369	37,740	17,792	6,434	2,153	528	170	71	2	3	—	—	—
Tamarack	105,253	40,019	28,783	24,141	8,694	2,685	756	134	29	10	—	—	2	—	—
Northern white-cedar	77,626	22,794	18,465	18,962	9,963	4,387	1,882	730	285	103	43	8	4	—	—
Other softwoods	106	—	—	76	24	—	6	—	—	—	—	—	—	—	—
Total softwoods	798,189	308,393	227,168	142,597	70,015	28,151	11,054	4,692	2,850	1,800	593	533	327	13	3
Hardwoods:															
Select white oaks	89,517	38,981	25,886	12,642	6,033	2,935	1,619	746	346	173	85	38	31	2	—
Select red oaks	57,252	12,659	10,216	12,522	10,625	6,052	2,803	1,351	571	252	127	39	33	2	—
Other red oaks	718	378	138	90	56	41	8	4	—	3	—	—	—	—	—
Hickory	198	—	123	—	57	10	8	—	—	—	—	—	—	—	—
Yellow birch	2,133	1,103	504	246	99	52	55	45	12	11	3	2	1	—	—
Hard maple	105,767	61,495	28,978	8,734	3,158	1,563	815	572	265	135	33	12	6	1	—
Soft maple	71,241	35,581	21,757	9,406	2,727	1,033	376	141	97	62	31	10	16	4	—
Ash	201,976	109,541	46,549	24,232	12,351	5,748	2,251	811	340	92	53	5	3	—	—
Balsam poplar	135,790	67,936	27,803	17,270	11,173	6,066	3,355	1,402	573	145	42	7	18	—	—
Paper birch	204,134	50,785	57,844	50,255	27,076	12,163	4,063	1,444	369	93	33	6	3	—	—
Bigtooth aspen	25,339	6,555	4,314	4,216	4,601	3,337	1,460	563	205	74	10	4	—	—	—
Quaking aspen	602,327	293,054	106,650	74,988	59,636	39,652	18,415	6,795	2,233	676	156	56	16	—	—
Basswood	74,343	24,953	16,249	13,822	9,535	5,385	2,553	1,084	446	188	77	31	19	1	—
Elm	69,716	28,794	16,527	10,196	6,418	3,529	1,827	1,083	598	395	172	92	76	9	—
Select hardwoods	3,140	2,247	412	247	145	60	22	—	7	—	—	—	—	—	—
Other hardwoods	3,457	2,137	979	144	108	44	26	11	5	—	3	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	1,647,048	736,199	364,929	239,010	153,798	87,670	39,656	16,052	6,067	2,299	825	302	222	19	—
All species	2,445,237	1,044,592	592,097	381,607	223,813	115,821	50,710	20,744	8,917	4,099	1,418	835	549	32	3

Table 15.—*Number of short-log trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	18	—	—	9	3	—	2	—	4	—	—
Red pine	31	22	—	4	—	3	2	—	—	—	—
Jack pine	202	112	47	35	8	—	—	—	—	—	—
White spruce	26	26	—	—	—	—	—	—	—	—	—
Black spruce	42	38	—	—	4	—	—	—	—	—	—
Balsam fir	149	107	14	10	4	14	—	—	—	—	—
Tamarack	192	124	62	6	—	—	—	—	—	—	—
Northern white-cedar	555	330	155	32	19	12	3	2	2	—	—
Other softwoods	18	11	—	—	4	—	3	—	—	—	—
Total softwoods	1,233	770	278	96	42	29	10	2	6	—	—
Hardwoods:											
Select white oaks	186	—	102	45	19	12	—	8	—	—	—
Select red oaks	353	—	174	112	43	17	3	4	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	41	—	12	22	5	—	—	2	—	—	—
Hard maple	271	—	88	102	53	14	7	4	3	—	—
Soft maple	88	—	27	14	15	8	9	4	7	4	—
Ash	176	—	121	24	24	3	—	2	2	—	—
Balsam poplar	150	—	82	36	16	16	—	—	—	—	—
Paper birch	323	—	187	76	44	12	—	—	4	—	—
Bigtooth aspen	130	—	56	45	12	17	—	—	—	—	—
Quaking aspen	2,142	—	1,248	507	244	97	28	10	8	—	—
Basswood	158	—	71	34	26	12	10	5	—	—	—
Elm	378	—	204	67	47	23	15	10	9	3	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,396	—	2,372	1,084	548	231	72	49	33	7	—
All species	5,629	770	2,650	1,180	590	260	82	51	39	7	—

Table 16.—*Net volume of growing stock and sawtimber on commercial forest land by species, Northern Pine Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	[1]1962	1977	[1]1962	1977
	Thousand cubic feet		*Thousand board feet*[2]	
Softwoods:				
White pine	71,497	90,495	335,521	489,804
Red pine	191,411	273,024	900,416	1,310,295
Jack pine	304,917	370,689	583,306	952,613
Spruce	144,741	155,751	151,211	255,963
Balsam fir	262,132	328,134	271,097	588,296
Tamarack	145,681	150,313	135,542	210,950
Northern white-cedar	89,087	140,654	133,292	373,920
Other softwoods	—	394	—	364
Total softwoods	1,209,466	1,509,454	2,510,385	4,182,205
Hardwoods:				
White oak	76,765	119,986	225,083	264,498
Red oak	139,834	218,539	331,407	440,724
Yellow birch	3,597	3,552	16,515	11,866
Hard maple	62,866	83,680	212,342	204,393
Soft maple	33,525	49,757	82,683	75,450
Ash	174,528	241,200	310,468	352,993
Paper birch	334,140	538,764	194,904	570,799
Aspen	1,270,624	1,642,259	1,005,318	3,056,545
Basswood	124,132	203,813	371,875	413,860
Elm	93,681	141,808	344,830	468,485
Other hardwoods	193,156	270,082	295,567	578,932
Total hardwoods	2,506,848	3,513,440	3,390,992	6,438,545
All species	3,716,314	5,022,894	5,901,377	10,620,750

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.
[2]International ¼-inch rule.

Table 17.—*Cubic foot volume in all live trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	95,678	4,469	4,032	10,816	5,020	9,981	12,334	15,402	5,953	8,395	17,397	1,561	318
Red pine	274,941	8,896	25,971	25,081	27,589	37,652	51,059	49,138	20,036	20,746	8,446	327	—
Jack pine	388,506	73,337	117,397	93,335	62,289	27,630	10,856	2,612	582	396	72	—	—
White spruce	43,384	5,256	5,224	6,424	7,068	6,044	4,857	3,495	2,775	1,372	869	—	—
Black spruce	119,809	59,086	39,715	15,317	3,373	1,055	793	115	355	—	—	—	—
Balsam fir	344,770	97,414	103,901	73,438	43,633	14,730	7,026	4,301	85	242	—	—	—
Tamarack	166,518	67,064	51,143	30,032	13,202	3,492	1,037	418	35	—	95	—	—
Northern white-cedar	179,278	36,243	43,402	38,022	29,270	16,917	8,586	3,993	1,876	690	279	—	—
Other softwoods	907	303	121	99	128	113	73	—	70	—	—	—	—
Total softwoods	1,613,791	352,068	390,906	292,564	191,572	117,614	96,621	79,474	31,767	31,841	27,158	1,888	318
Hardwoods:													
Select white oaks	134,111	24,843	27,588	24,238	20,706	14,340	9,319	5,776	3,514	2,105	1,552	130	—
Select red oaks	243,686	31,749	55,611	54,407	40,149	28,024	15,571	8,342	5,767	2,095	1,738	233	—
Other red oaks	1,061	252	262	315	58	85	—	89	—	—	—	—	—
Hickory	520	—	335	99	86	—	—	—	—	—	—	—	—
Yellow birch	6,469	861	801	803	998	1,325	614	423	144	288	186	26	—
Hard maple	127,878	23,386	19,965	24,803	17,508	18,556	12,305	6,855	2,538	1,164	696	102	—
Soft maple	68,659	18,271	15,025	10,369	6,524	4,300	4,473	3,512	2,170	1,116	1,931	968	—
Ash	265,524	58,707	69,340	60,826	38,397	19,408	11,094	4,031	2,982	336	403	—	—
Balsam poplar	290,588	42,720	65,662	65,490	55,341	33,859	17,623	6,117	2,033	582	1,161	—	—
Paper birch	614,334	155,209	182,983	142,070	75,121	38,346	13,556	4,355	1,957	500	237	—	—
Bigtooth aspen	143,005	13,488	33,778	40,042	27,265	15,812	7,520	3,478	1,187	391	44	—	—
Quaking aspen	1,832,504	232,453	420,996	488,496	355,453	191,083	88,185	36,780	12,110	5,101	1,826	21	—
Basswood	225,603	30,818	50,163	51,114	38,201	24,034	14,448	8,041	4,428	2,098	2,122	136	—
Elm	160,028	13,647	21,701	23,589	23,277	21,119	16,504	15,208	9,022	6,489	7,133	2,339	—
Select hardwoods	2,802	911	819	594	272	—	170	—	—	—	36	—	—
Other hardwoods	3,923	778	849	623	545	290	338	58	244	111	87	—	—
Noncommercial species	3,186	1,536	671	380	280	—	184	—	135	—	—	—	—
Total hardwoods	4,123,881	649,629	966,549	988,258	700,181	410,581	211,904	103,065	48,231	22,376	19,152	3,955	—
All species	5,737,672	1,001,697	1,357,455	1,280,822	891,753	528,195	308,525	182,539	79,998	54,217	46,310	5,843	318

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwooods and hardwoods, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing-stock trees:			
Sawlog trees:			
Sawlog portion	1,554,831	643,454	911,377
Upper-stem portion	515,829	178,157	337.672
Total sawtimber	2,070,660	821,611	1,249,049
Poletimber trees	2,952,234	687,843	2,264,391
Total growing stock	5,022,894	1,509,454	3,513,440
Cull trees:			
Rough and rotten cull trees:			
Sawtimber	234,059	37,606	196,453
Poletimber	395,173	55,130	340,043
Total rough and rotten cull	629,232	92,736	536,496
Short-log cull trees:			
Sawtimber	85,546	11,601	73,945
Poletimber	—	—	—
Total short-log	85,546	11,601	73,945
Total cull	714,778	104,337	610,441
Salvable dead trees:	66,139	30,217	35,922
All classes	5,803,811	1,644,008	4,159,803

Table 19.—*Net volume of growing stock on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	90,495	4,215	3,979	16,501	30,615	5,309	3,256	3,693	22,334	155	30	—	408
Red pine	273,024	1,913	7,151	37,806	84,764	10,303	14,457	19,439	89,874	2,765	90	—	4,462
Jack pine	370,689	2,244	22,148	50,695	70,765	6,016	40,629	66,626	45,407	24,196	1,375	16,466	24,122
White spruce	42,389	3,663	2,711	6,300	3,356	1,173	981	2,503	16,942	2,718	255	1,297	490
Black spruce	113,362	9,767	2,502	20,026	10,223	3,954	242	3,478	42,398	15,710	63	4,710	289
Balsam fir	328,134	22,870	9,606	40,957	50,581	10,647	4,680	7,290	166,592	11,176	271	3,362	102
Tamarack	150,313	26,802	7,191	33,810	14,714	9,157	5,251	4,126	24,428	14,326	1,067	8,258	1,183
Northern white-cedar	140,654	7,096	—	37,716	20,161	1,994	250	1,126	53,083	14,135	—	5,093	—
Other softwoods	394	184	—	—	89	—	—	—	121	—	—	—	—
Total softwoods	1,509,454	78,754	55,288	243,811	285,268	48,553	69,746	108,281	461,179	85,181	3,151	39,186	31,056
Hardwoods:													
Select white oak	119,986	11,865	17,105	10,412	20,687	8,129	15,675	10,855	7,458	965	11,517	1,178	4,140
Select red oak	217,524	26,231	23,645	5,723	49,927	10,592	57,066	18,070	17,168	—	5,228	—	3,874
Other red oaks	1,015	69	792	—	—	—	—	154	—	—	—	—	—
Hickory	520	247	—	—	—	—	273	—	—	—	—	—	—
Yellow birch	3,552	1,058	—	242	—	—	539	—	1,713	—	—	—	—
Hard maple	83,680	33,654	7,360	7,607	7,097	5,013	3,371	1,456	16,437	—	1,685	—	—
Soft maple	49,757	17,460	746	3,605	8,374	1,626	5,013	1,274	11,472	—	130	—	57
Ash	241,200	58,992	10,424	33,787	24,620	8,062	13,566	4,220	68,856	5,957	4,326	5,217	3,173
Balsam poplar	265,529	18,776	6,696	56,929	20,728	22,401	824	9,629	75,839	26,024	7,134	16,215	4,334
Paper birch	538,764	54,527	38,416	60,633	114,616	28,339	40,456	34,933	141,622	12,735	6,114	4,693	1,680
Bigtooth aspen	123,016	5,550	8,765	7,510	29,399	8,368	17,259	19,760	24,860	754	—	—	791
Quaking aspen	1,519,243	117,873	98,684	205,710	245,129	92,627	91,741	127,877	401,816	57,925	29,118	29,068	21,675
Basswood	203,813	40,199	19,875	24,199	29,977	15,215	8,131	5,863	44,264	777	14,371	238	704
Elm	141,808	21,825	16,138	23,286	18,269	17,749	2,645	2,110	24,353	2,483	8,118	3,565	1,267
Select hardwoods	2,005	404	553	—	89	—	862	42	—	—	55	—	—
Other hardwoods	2,028	130	581	281	90	123	—	—	118	—	424	56	225
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	408,860	249,780	439,924	569,002	218,244	257,421	236,243	835,976	107,620	88,220	60,230	41,920
All species	5,022,894	487,614	305,068	683,735	854,270	266,797	327,167	344,524	1,297,155	192,801	91,371	99,416	72,976

Table 20.—*Net volume of sawtimber on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	489,804	23,822	20,725	83,667	170,166	30,974	16,376	18,413	121,642	1,186	—	—	2,833
Red pine	1,310,295	10,130	32,424	170,545	433,619	51,618	63,579	84,801	443,006	4,594	568	—	15,411
Jack pine	952,613	4,144	55,290	148,006	178,454	15,719	83,806	167,348	139,345	60,432	2,196	53,389	44,484
White spruce	168,448	15,812	11,404	21,862	15,172	5,236	2,443	11,458	67,493	9,472	1,220	4,391	2,485
Black spruce	87,515	4,235	3,366	10,791	9,289	4,836	—	8,964	34,315	7,498	—	3,868	353
Balsam fir	588,296	43,820	20,283	70,115	103,746	17,551	5,178	11,391	293,388	15,064	510	7,250	—
Tamarack	210,950	38,801	15,581	38,607	15,806	21,048	10,789	7,627	34,840	17,615	3,829	6,407	—
Northern white-cedar	373,920	21,282	—	59,471	69,147	7,635	—	5,307	167,938	26,616	—	16,524	—
Other softwoods	364	—	—	—	364	—	—	—	—	—	—	—	—
Total softwoods	4,182,205	162,046	159,073	603,064	995,763	154,617	182,171	315,309	1,301,967	142,477	8,323	91,829	65,566
Hardwoods:													
Select white oaks	264,498	25,811	48,217	19,484	45,659	16,444	31,990	19,247	17,575	3,731	25,666	3,313	7,361
Select red oaks	439,583	69,744	61,925	6,823	92,021	32,191	110,207	23,369	22,197	—	9,407	—	11,699
Other red oaks	1,141	—	851	—	—	—	—	290	—	—	—	—	—
Hickory	444	—	—	—	—	—	444	—	—	—	—	—	—
Yellow birch	11,866	2,453	—	328	—	—	2,382	—	6,703	—	—	—	—
Hard maple	204,393	103,735	10,714	16,942	11,467	10,733	4,113	1,624	42,377	—	2,688	—	—
Soft maple	75,450	31,032	366	7,448	7,251	4,227	5,958	1,137	18,031	—	—	—	—
Ash	352,993	90,178	15,215	53,566	38,774	12,276	17,759	4,741	94,710	7,210	7,206	5,024	6,334
Balsam poplar	572,553	59,634	16,354	97,274	53,054	38,128	1,000	16,668	197,456	46,607	17,169	22,270	6,939
Paper birch	570,799	69,701	53,639	82,687	104,251	23,491	18,736	20,204	156,431	21,987	10,874	8,798	—
Bigtooth aspen	213,453	17,453	12,878	16,513	57,824	8,589	30,658	12,728	56,810	—	—	—	—
Quaking aspen	2,843,092	234,261	140,893	371,134	506,972	139,917	165,077	186,816	886,148	98,880	47,271	43,336	22,387
Basswood	413,860	93,966	46,920	55,007	57,584	25,648	14,202	3,473	91,870	3,847	17,612	819	2,912
Elm	468,485	78,612	52,112	76,404	57,292	55,062	6,704	2,932	95,708	9,839	20,909	7,979	4,932
Select hardwoods	2,223	916	—	—	—	—	1,307	—	—	—	—	—	—
Other hardwoods	3,712	330	1,204	1,056	—	—	—	—	—	—	1,122	—	—
Noncommercial	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	877,826	461,288	804,666	1,032,149	366,706	410,537	293,229	1,686,016	192,101	159,924	91,539	62,564
All species	10,620,750	1,039,872	620,361	1,407,730	2,027,912	521,323	592,708	608,538	2,987,983	334,578	168,247	183,368	128,130

[1]International ¼-inch rule.

Table 21.—*Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Northern Pine Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				*Thousand board feet*[1]
Softwoods:					
White pine	95,678	90,495	563	4,620	489,804
Red pine	274,941	273,024	402	1,515	1,310,295
Jack pine	388,506	370,689	2,067	15,750	952,613
White spruce	43,384	42,389	117	878	168,448
Black spruce	119,809	113,362	421	6,026	87,515
Balsam fir	344,770	328,134	1,890	14,746	588,296
Tamarack	166,518	150,313	1,798	14,407	210,950
Northern white-cedar	179,278	140,654	4,140	34,484	373,920
Eastern redcedar	907	394	203	310	364
Total softwoods	1,613,791	1,509,454	11,601	92,736	4,182,205
Hardwoods:					
White oak	2,636	2,574	—	62	6,139
Burr oak	131,475	117,412	2,442	11,621	258,359
Swamp white oak	—	—	—	—	—
Northern red oak	243,686	217,524	4,762	21,400	439,583
Black oak	—	—	—	—	—
Northern pin oak	1,061	1,015	—	46	1,141
Bitternut hickory	520	520	—	—	444
Shagbark hickory	—	—	—	—	—
Yellow birch	6,469	3,552	575	2,342	11,866
Sugar maple	127,878	83,680	5,387	38,811	204,393
Black maple	—	—	—	—	—
Red maple	58,518	41,882	1,052	15,584	46,619
Silver maple	10,141	7,875	1,112	1,154	28,831
White ash	336	—	—	336	—
Black ash	235,759	215,469	2,969	17,321	316,683
Green ash	29,429	25,731	—	3,698	36,310
Balsam poplar	290,588	265,529	2,542	22,517	572,553
Paper birch	614,334	538,764	5,385	70,185	570,799
Bigtooth aspen	143,005	123,016	2,472	17,517	213,453
Quaking aspen	1,832,504	1,519,243	36,840	276,421	2,843,092
Basswood	225,603	203,813	2,976	18,814	413,860
American elm	154,610	136,658	5,431	12,521	448,189
Slippery elm	4,385	4,153	—	232	18,380
Rock elm	1,033	997	—	36	1,916
Butternut	1,394	1,266	—	128	2,223
Black walnut	—	—	—	—	—
Black cherry	1,408	739	—	669	—
Boxelder	3,715	1,820	—	1,895	3,712
River birch	—	—	—	—	—
Hackberry	—	—	—	—	—
Eastern cottonwood	118	118	—	—	—
Black willow	90	90	—	—	—
Noncommercial	3,186	—	—	3,186	—
Total hardwoods	4,123,881	3,513,440	73,945	536,496	6,438,545
All species	5,737,672	5,022,894	85,546	629,232	10,620,750

[1]International ¼-inch rule.

Table 22.—*Net volume of growing stock on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	90,495	3,638	3,271	10,584	4,926	9,637	10,787	15,309	5,867	8,038	16,709	1,411	318
Red pine	273,024	8,353	25,535	24,814	27,496	37,402	51,059	49,028	19,860	20,716	8,446	315	—
Jack pine	370,689	69,484	112,716	90,278	59,705	25,626	9,537	2,515	360	396	72	—	—
White spruce	42,389	4,961	5,042	6,129	6,845	6,044	4,857	3,495	2,775	1,372	869	—	—
Black spruce	113,362	54,639	38,694	14,565	3,312	1,055	627	115	355	—	—	—	—
Balsam fir	328,134	90,093	100,490	70,663	42,513	13,838	6,700	3,509	86	242	—	—	—
Tamarack	150,313	59,648	47,124	26,917	12,183	3,074	910	362	—	—	95	—	—
Northern white-cedar	140,654	28,818	35,033	29,726	21,880	13,400	6,529	3,261	1,507	369	131	—	—
Other softwoods	394	184	121	—	89	—	—	—	—	—	—	—	—
Total softwoods	1,509,454	319,818	368,026	273,676	178,949	110,076	91,006	77,594	30,810	31,133	26,322	1,726	318
Hardwoods:													
Select white oaks	119,986	22,703	25,181	21,797	18,532	12,694	7,869	4,886	3,176	1,702	1,344	102	—
Select red oaks	217,524	27,800	51,694	50,566	34,890	23,593	13,187	7,345	5,133	1,544	1,615	157	—
Other red oaks	1,015	212	256	315	58	85	—	89	—	—	—	—	—
Hickory	520	—	335	99	86	—	—	—	—	—	—	—	—
Yellow birch	3,552	502	511	381	612	699	269	317	78	111	72	—	—
Hard maple	83,680	18,362	14,569	13,572	11,144	11,694	7,318	4,700	1,284	579	398	60	—
Soft maple	49,757	15,263	10,743	7,776	4,816	2,568	2,631	2,201	1,398	562	1,234	565	—
Ash	241,200	52,807	64,318	55,060	35,017	17,688	9,776	3,324	2,739	237	234	—	—
Balsam poplar	265,529	37,697	59,938	59,691	51,827	31,160	16,361	5,462	1,824	450	1,119	—	—
Paper birch	538,764	132,145	160,837	128,545	65,868	34,065	11,519	3,575	1,742	335	133	—	—
Bigtooth aspen	123,016	11,793	29,422	36,139	23,659	12,662	5,956	2,657	508	220	—	—	—
Quaking aspen	1,519,243	197,905	358,962	419,307	294,952	151,105	63,569	23,466	6,500	2,586	891	—	—
Basswood	203,813	27,229	46,640	46,889	35,350	22,101	12,653	6,491	3,605	1,340	1,466	49	—
Elm	141,808	12,578	19,636	21,371	20,648	18,683	14,813	13,849	7,932	5,322	5,707	1,269	—
Select hardwoods	2,005	468	567	528	272	—	170	—	—	—	—	—	—
Other hardwoods	2,028	406	465	410	327	183	124	—	113	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	557,870	844,074	862,446	598,058	338,980	166,215	78,362	36,032	14,988	14,213	2,202	—
All species	5,022,894	877,688	1,212,100	1,136,122	777,007	449,056	257,221	155,956	66,842	46,121	40,535	3,928	318

Table 23.—*Net volume of sawtimber on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	489,804	69,371	29,254	55,674	61,709	85,998	33,193	45,080	98,478	8,716	2,331
Red pine	1,310,295	121,529	134,725	188,676	267,237	277,045	120,786	135,990	61,136	3,171	—
Jack pine	952,613	484,952	290,581	118,682	42,763	11,810	1,539	1,991	295	—	—
White spruce	168,448	32,947	35,084	30,379	24,767	18,061	14,879	7,495	4,836	—	—
Black spruce	87,515	63,503	13,933	4,569	3,087	577	1,846	—	—	—	—
Balsam fir	588,296	307,453	176,728	57,004	29,345	16,019	382	1,365	—	—	—
Tamarack	210,950	127,968	58,941	15,737	5,219	2,165	—	—	920	—	—
Northern white-cedar	373,920	151,706	103,693	62,124	31,194	15,110	7,396	1,923	774	—	—
Other softwoods	364	—	364	—	—	—	—	—	—	—	—
Total softwoods	4,182,205	1,359,429	843,303	532,845	465,321	426,785	180,021	193,844	166,439	11,887	2,331
Hardwoods:											
Select white oaks	264,498	—	95,249	65,642	40,814	25,248	17,211	9,686	9,741	907	—
Select red oaks	439,583	—	171,605	119,408	65,710	37,653	26,775	8,427	8,953	1,052	—
Other red oaks	1,141	—	290	337	—	514	—	—	—	—	—
Hickory	444	—	444	—	—	—	—	—	—	—	—
Yellow birch	11,866	—	3,049	3,396	1,945	1,999	436	592	449	—	—
Hard maple	204,393	—	60,557	63,771	39,956	26,241	7,346	3,593	2,459	470	—
Soft maple	75,450	—	24,463	12,796	12,056	10,366	6,412	2,329	4,757	2,271	—
Ash	352,993	—	172,163	91,169	51,135	18,779	16,307	1,537	1,903	—	—
Balsam poplar	572,553	—	270,470	164,489	86,145	30,216	10,477	2,804	7,952	—	—
Paper birch	570,799	—	332,638	159,818	52,042	16,148	8,293	1,327	533	—	—
Bigtooth aspen	213,453	—	108,533	60,444	28,233	12,362	2,461	1,420	—	—	—
Quaking aspen	2,843,092	—	1,598,964	768,066	317,474	111,549	30,414	12,473	4,152	—	—
Basswood	413,860	—	171,344	109,616	63,635	34,227	18,583	7,509	8,489	457	—
Elm	468,485	—	120,341	103,215	76,765	69,067	40,211	25,549	27,313	6,024	—
Select hardwoods	2,223	—	1,307	—	916	—	—	—	—	—	—
Other hardwoods	3,712	—	1,620	897	611	—	584	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	—	3,133,037	1,723,064	837,437	394,369	185,510	77,246	76,701	11,181	—
All species	10,620,750	1,359,429	3,976,340	2,255,909	1,302,758	821,154	365,531	271,090	243,140	23,068	2,331

[1]International ¼-inch rule.

Table 24.—*Net volume of growing stock on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	90,495	1,038	30,816	21,468	1,616	572	41	91	715	1,465	386	7,456	17,257	7,237	337	—
Red pine	273,024	33,592	149,314	12,384	3,018	413	—	—	514	4,510	70	661	53,624	14,701	223	—
Jack pine	370,689	283,392	7,526	1,739	1,691	2,249	395	98	837	6,503	141	144	57,224	7,661	1,089	—
White spruce	42,389	1,330	760	485	4,647	4,964	334	500	358	497	1,218	2,560	19,762	3,273	1,701	—
Black spruce	113,362	3,748	320	249	14,174	324	60,131	12,426	12,265	86	459	106	6,765	1,333	840	136
Balsam fir	328,134	1,728	11,802	1,321	74,489	1,503	4,087	8,338	1,946	513	18,267	28,504	127,485	28,255	16,265	3,631
Tamarack	150,313	125	195	—	5,416	277	13,357	7,804	104,587	214	1,706	500	8,226	3,641	3,879	386
Northern white-cedar	140,654	—	—	—	10,842	566	3,630	82,394	2,829	—	19,622	1,936	10,336	5,838	2,480	181
Other softwoods	394	—	—	—	—	—	184	—	—	—	89	—	—	—	121	—
Total softwoods	1,509,454	324,953	200,733	37,646	115,893	10,868	82,159	111,651	124,051	13,788	41,958	41,867	300,679	71,939	26,935	4,334
Hardwoods:																
Select white oaks	119,986	823	226	320	613	29	—	—	—	30,760	4,310	19,154	56,346	5,896	1,509	—
Select red oaks	217,524	2,628	742	108	62	—	112	—	51	84,206	684	22,882	83,961	21,723	355	—
Other red oaks	1,015	—	—	—	—	—	—	—	—	58	—	89	799	69	—	—
Hickory	520	—	—	—	—	—	—	—	—	189	—	146	—	185	—	—
Yellow birch	3,552	—	—	—	—	—	—	—	—	—	627	2,407	169	349	—	—
Hard maple	83,680	—	—	221	—	—	—	—	—	1,159	755	61,397	15,248	4,174	726	—
Soft maple	49,757	66	56	42	494	—	179	—	117	2,837	6,873	17,552	17,291	4,138	112	—
Ash	241,200	64	129	—	4,179	—	336	2,996	336	1,895	126,484	38,969	44,362	11,914	9,536	—
Balsam poplar	265,529	579	559	46	6,580	622	118	2,160	2,008	782	12,875	9,605	108,432	11,562	109,601	—
Paper birch	538,764	6,965	20,457	2,836	16,945	369	970	5,299	1,917	22,101	14,596	46,230	213,668	174,661	10,713	1,037
Bigtooth aspen	123,016	3,248	2,786	—	66	—	204	—	—	6,155	1,104	5,542	97,035	6,760	116	—
Quaking aspen	1,519,243	14,134	5,609	1,388	14,495	2,101	2,405	934	1,678	24,825	10,895	43,292	1,328,065	36,080	31,854	1,688
Basswood	203,813	63	—	465	970	—	—	—	—	9,590	7,641	123,967	49,579	10,007	1,531	—
Elm	141,808	124	43	—	1,015	—	79	54	484	2,391	30,834	51,212	39,878	9,027	6,667	—
Select hardwoods	2,005	—	—	—	—	—	—	—	—	839	—	402	605	159	—	—
Other hardwoods	2,028	225	118	—	—	—	—	—	—	76	184	1,149	276	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	28,919	30,725	5,426	45,419	3,121	4,403	11,443	6,591	187,863	217,662	443,995	2,055,714	296,704	172,730	2,725
All species	5,022,894	353,872	231,458	43,072	161,312	13,989	86,562	123,094	130,642	201,651	259,620	485,862	2,356,393	368,643	199,665	7,059

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	489,804	4,918	170,415	113,793	9,677	3,353	286	644	4,371	8,376	2,188	42,247	86,718	40,905	1,913	—
Red pine	1,310,295	122,058	758,670	63,199	14,319	1,670	—	—	2,293	19,774	—	3,790	248,828	74,625	1,069	—
Jack pine	952,613	664,539	26,528	5,178	7,818	9,631	1,845	253	2,319	18,450	—	513	186,662	27,981	896	—
White spruce	168,448	2,235	1,433	1,853	19,209	17,981	623	1,579	1,028	2,357	4,832	11,904	81,185	15,204	7,025	—
Black spruce	87,515	3,781	—	547	19,004	1,404	28,810	12,945	6,673	353	1,169	—	8,324	2,018	2,103	384
Balsam fir	588,296	2,096	41,149	1,685	118,422	1,849	4,184	6,338	2,496	493	29,357	66,166	224,730	43,085	36,243	10,003
Tamarack	210,950	687	354	—	11,633	1,174	16,550	6,185	111,118	1,101	3,974	1,213	27,530	12,131	15,546	1,754
Northern white-cedar	373,920	—	—	—	32,673	2,251	7,209	176,672	6,217	—	74,936	6,444	35,530	21,887	9,296	805
Other softwoods	364	—	—	—	—	—	—	—	—	—	364	—	—	—	—	—
Total softwoods	4,182,205	800,314	998,549	186,255	232,755	39,313	59,507	204,616	136,515	50,904	116,820	132,277	899,507	237,836	74,091	12,946
Hardwoods:																
Select white oaks	264,498	393	—	—	1,904	—	—	—	—	73,869	13,931	54,829	108,456	7,061	4,055	—
Select red oaks	439,583	1,531	2,005	—	—	—	—	—	287	160,774	487	67,701	167,393	38,386	1,019	—
Other red oaks	1,141	—	—	—	—	—	—	—	—	290	—	514	337	—	—	—
Hickory	444	—	—	—	—	—	—	—	—	—	—	—	—	444	—	—
Yellow birch	11,866	—	—	—	—	—	—	—	—	—	2,015	9,060	463	328	—	—
Hard maple	204,393	—	—	1,344	—	—	—	—	—	959	1,928	180,054	16,507	3,000	601	—
Soft maple	75,450	—	—	—	927	—	684	—	—	1,385	22,140	33,644	13,487	3,183	—	—
Ash	352,993	—	—	—	2,037	—	—	3,841	—	1,637	210,127	56,594	51,371	11,780	15,606	—
Balsam poplar	572,553	975	—	—	19,807	750	—	5,283	4,430	1,298	41,705	25,718	215,658	28,791	228,138	—
Paper birch	570,799	3,528	35,931	1,975	23,232	767	1,189	7,467	1,660	13,267	26,129	85,873	195,543	151,677	22,013	548
Bigtooth aspen	213,453	1,181	318	—	—	—	393	—	—	17,490	2,877	16,471	162,112	12,611	—	—
Quaking aspen	2,843,092	13,013	6,922	1,666	26,250	6,216	1,286	3,304	1,711	48,882	29,675	107,168	2,432,631	94,541	64,810	5,017
Basswood	413,860	—	—	1,296	2,946	—	—	—	—	9,496	26,551	285,626	65,003	20,747	2,195	—
Elm	468,485	424	—	—	3,553	—	—	256	811	4,981	119,444	187,246	109,530	19,979	22,261	—
Select hardwoods	2,223	—	—	—	—	—	—	—	—	810	—	440	973	—	—	—
Other hardwoods	3,712	—	—	—	—	—	—	—	—	—	634	3,078	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	21,045	45,176	6,281	80,656	7,733	3,552	20,151	8,899	335,138	497,643	1,114,016	3,539,464	392,528	360,698	5,565
All species	10,620,750	821,359	1,043,725	192,536	313,411	47,046	63,059	224,767	145,414	386,042	614,463	1,246,293	4,438,971	630,364	434,789	18,511

[1]International ¼-inch rule.

Table 26.—*Net volume of growing stock on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	90,495	36,866	—	10,886	729	5,694	9,306	1,042	15,271	—	1,305	8,422	—	974
Red pine	273,024	122,738	2,503	14,041	848	27,079	43,029	11,243	33,042	—	3,125	15,376	—	—
Jack pine	370,689	41,118	9,536	8,864	1,696	67,353	65,318	32,719	87,221	—	6,400	50,464	—	—
White spruce	42,389	3,637	1,360	1,954	861	7,770	8,287	3,177	10,317	—	1,017	4,009	—	—
Black spruce	113,362	9,393	2,847	8,486	2,134	50,159	19,258	3,066	12,166	—	1,225	4,628	—	—
Balsam fir	328,134	84,130	727	10,815	3,192	55,747	73,131	14,689	52,248	—	4,218	28,919	—	318
Tamarack	150,313	7,440	489	17,272	1,356	66,126	22,875	1,926	23,527	—	5,502	3,800	—	—
Northern white-cedar	140,654	25,172	3,508	21,850	1,206	50,250	12,725	2,703	12,980	—	—	10,260	—	—
Other softwoods	394	—	—	—	—	394	—	—	—	—	—	—	—	—
Total softwoods	1,509,454	330,494	20,970	94,168	12,022	330,572	253,929	70,565	246,772	—	22,792	125,878	—	1,292
Hardwoods:														
Select white oaks	119,986	8,109	84	7,188	1,334	8,223	17,828	1,079	54,190	—	2,693	19,175	—	83
Select red oaks	217,524	10,862	—	4,399	2,246	26,082	45,920	3,595	62,362	—	6,831	53,584	—	1,643
Other red oaks	1,015	—	—	—	—	165	58	—	792	—	—	—	—	—
Hickory	520	—	—	—	—	—	185	—	247	—	—	88	—	—
Yellow birch	3,552	—	—	—	—	260	872	473	309	—	399	1,239	—	—
Hard maple	83,680	2,526	—	4,256	1,247	14,968	20,063	3,907	18,353	—	1,870	16,228	—	262
Soft maple	49,757	2,643	—	914	336	6,993	15,855	1,513	10,749	—	1,815	8,939	—	—
Ash	241,200	15,633	1,377	12,195	1,960	46,998	44,123	12,651	64,688	—	6,043	35,532	—	—
Balsam poplar	265,529	13,055	1,091	21,602	3,544	56,738	48,411	10,322	76,519	—	5,007	29,089	—	151
Paper birch	538,764	72,521	713	24,757	7,475	76,673	133,662	20,928	103,141	—	14,581	83,669	—	644
Bigtooth aspen	123,016	5,760	134	2,119	397	21,260	30,029	4,949	25,109	—	5,130	27,864	—	265
Quaking aspen	1,519,243	142,207	9,125	97,872	9,694	280,163	344,064	61,958	343,980	—	47,105	182,306	—	769
Basswood	203,813	24,617	—	13,657	3,104	22,448	44,957	5,692	49,332	—	6,885	32,938	—	183
Elm	141,808	12,071	480	7,910	1,109	12,771	30,053	3,931	56,727	—	3,253	13,460	—	43
Select hardwoods	2,005	—	—	—	139	314	212	—	918	—	211	211	—	—
Other hardwoods	2,028	—	—	62	245	—	118	—	1,446	—	—	157	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	310,004	13,004	196,931	32,830	574,056	776,410	130,998	868,862	—	101,823	504,479	—	4,043
All species	5,022,894	640,498	33,974	291,099	44,852	904,628	1,030,339	201,563	1,115,634	—	124,615	630,357	—	5,335

Table 27.—*Net volume of sawtimber on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	489,804	202,631	—	52,306	3,967	32,741	50,717	6,467	84,543	—	6,598	45,521	—	4,313
Red pine	1,310,295	633,527	3,970	64,106	4,478	117,686	202,497	37,871	154,297	—	13,199	78,664	—	—
Jack pine	952,613	117,014	25,701	25,459	4,972	198,326	166,480	52,927	223,768	—	16,888	121,078	—	—
White spruce	168,448	16,618	7,353	7,176	3,632	25,673	31,283	12,252	41,979	—	5,157	17,325	—	—
Black spruce	87,515	9,305	2,280	3,080	4,123	34,212	17,951	4,953	8,946	—	—	2,665	—	—
Balsam fir	588,296	195,638	1,642	13,561	8,733	88,880	112,960	27,059	82,736	—	6,448	50,111	—	528
Tamarack	210,950	16,402	1,174	17,997	2,771	77,833	34,117	524	46,194	—	7,727	6,211	—	—
Northern white-cedar	373,920	88,109	5,604	35,023	3,828	124,278	35,448	7,735	32,570	—	—	41,325	—	—
Other softwoods	364	—	—	—	—	364	—	—	—	—	—	—	—	—
Total softwoods	4,182,205	1,279,244	47,724	218,708	36,504	699,993	651,453	149,788	675,033	—	56,017	362,900	—	4,841
Hardwoods:														
Select white oaks	264,498	25,896	429	13,597	4,928	20,335	35,446	467	121,644	—	5,716	36,040	—	—
Select red oks	439,583	13,077	—	4,038	5,568	48,605	84,968	2,679	143,085	—	16,458	117,674	—	3,431
Other red oaks	1,141	—	—	—	—	—	290	—	851	—	—	—	—	—
Hickory	444	—	—	—	—	—	444	—	—	—	—	—	—	—
Yellow birch	11,866	—	—	—	—	284	3,373	2,077	328	—	1,347	4,457	—	—
Hard maple	204,393	—	—	8,672	2,303	42,786	47,982	13,840	36,164	—	2,918	49,728	—	—
Soft maple	75,450	463	—	466	606	11,791	25,436	1,493	15,694	—	2,875	16,626	—	—
Ash	352,993	17,470	2,258	15,957	1,744	59,162	72,670	24,236	102,567	—	8,032	48,897	—	—
Balsam poplar	572,553	37,353	1,916	29,854	3,219	124,978	120,966	25,351	161,333	—	12,510	54,192	—	881
Paper birch	570,799	85,509	1,058	36,397	14,510	94,342	97,940	19,429	117,078	—	14,085	90,451	—	—
Bigtooth aspen	213,453	12,135	—	3,166	695	25,028	37,672	13,117	60,066	—	12,532	48,302	—	740
Quaking aspen	2,843,092	298,111	20,611	175,070	19,965	429,499	685,775	121,679	632,456	—	101,013	355,118	—	3,795
Basswood	413,860	36,841	—	31,201	6,912	49,781	79,426	10,243	94,001	—	15,412	89,264	—	779
Elm	468,485	46,860	1,777	22,488	4,316	37,973	91,425	13,438	195,283	—	10,977	43,948	—	—
Select hardwoods	2,223	—	—	—	440	—	—	—	—	—	789	994	—	—
Other hardwoods	3,712	—	—	304	1,204	—	—	—	2,204	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	573,715	28,049	341,210	66,410	944,564	1,383,813	248,049	1,682,754	—	204,664	955,691	—	9,626
All species	10,620,750	1,852,959	75,773	559,918	102,914	1,644,557	2,035,266	397,837	2,357,787	—	260,681	1,318,591	—	14,467

[1]International ¼-inch rule.

Table 28.—*Net volume of growing stock on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	353,872	4,343	2,986	20,706	94,309	101,588	84,422	37,145	7,139	—	1,234	—	—	—
Red pine	231,458	994	516	5,610	9,006	14,155	8,774	14,509	114,819	1,704	59,788	1,583	—	—
White pine	43,072	—	—	—	1,329	10,006	4,608	3,947	2,749	2,625	5,306	12,502	—	—
Balsam fir	161,312	2,491	3,580	13,437	10,153	39,223	32,993	40,370	16,392	1,825	—	848	—	—
White spruce	13,989	—	144	1,004	—	—	7,941	3,491	—	1,409	—	—	—	—
Black spruce	86,562	1,795	2,558	7,850	9,392	10,498	16,678	10,641	5,624	15,847	2,237	1,576	1,866	—
Northern white-cedar	123,094	358	498	2,200	3,011	3,023	11,497	19,881	9,214	15,693	9,597	15,277	30,238	2,607
Tamarack	130,642	1,547	5,909	4,410	5,161	9,630	31,233	8,202	13,618	13,014	5,243	19,230	13,445	—
Oak	201,651	1,290	3,974	1,664	19,374	54,667	45,521	31,903	23,984	5,355	7,739	6,180	—	—
Elm-ash-cottonwood	259,620	3,094	5,056	5,617	7,674	19,569	47,471	37,037	34,551	37,492	33,319	19,102	9,638	—
Maple-basswood	485,862	1,727	4,373	3,463	42,736	89,664	120,435	75,606	51,476	25,148	40,381	6,940	23,913	—
Aspen	2,356,393	74,320	67,559	131,014	460,418	790,310	537,987	193,068	59,499	27,050	9,794	2,885	2,489	—
Paper birch	368,643	963	3,388	5,613	43,923	109,395	95,561	60,944	20,771	16,769	6,320	4,996	—	—
Balsam poplar	199,665	6,099	10,465	12,712	27,979	61,143	42,157	24,678	11,249	3,183	—	—	—	—
Nonstocked	7,059	6,898	—	—	—	161	—	—	—	—	—	—	—	—
All types	5,022,894	105,919	111,006	215,300	734,465	1,313,032	1,087,278	561,422	371,085	167,114	180,958	91,119	81,589	2,607

Table 29.—*Net volume of sawtimber on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	821,359	9,056	5,816	18,688	171,268	230,893	238,642	114,774	28,798	—	3,424	—	—	—
Red pine	1,043,725	4,282	1,196	3,880	27,398	47,095	30,591	59,754	539,862	7,884	314,908	6,875	—	—
White pine	192,536	—	—	—	3,307	37,491	17,127	17,184	12,682	9,885	26,593	68,267	—	—
Balsam fir	313,411	9,404	3,512	22,832	19,103	66,393	60,316	98,463	30,240	803	—	2,345	—	—
White spruce	47,046	—	—	1,557	—	—	24,301	14,935	—	6,253	—	—	—	—
Black spruce	63,059	2,382	1,906	3,745	6,201	9,204	10,047	10,006	4,535	10,708	552	3,773	—	—
Northern white-cedar	224,767	908	—	2,403	2,946	4,942	18,527	20,757	23,693	14,244	13,005	30,242	83,582	9,518
Tamarack	145,414	915	6,430	4,711	1,430	9,369	37,753	8,015	24,051	16,247	6,241	21,693	8,559	—
Oak	386,042	538	10,105	1,478	31,089	58,380	70,951	76,389	72,842	17,730	28,497	18,043	—	—
Elm-ash-cottonwood	614,463	3,853	7,902	5,044	8,530	28,500	106,368	84,940	86,749	105,318	97,515	47,763	31,981	—
Maple-basswood	1,246,293	6,570	5,776	4,664	85,804	147,981	301,541	202,695	164,791	79,309	137,793	23,825	85,544	—
Aspen	4,438,971	148,339	86,406	155,919	623,054	1,392,254	1,244,158	487,252	171,392	81,939	33,741	6,957	7,560	—
Paper birch	630,364	950	4,092	5,768	63,906	139,978	172,153	114,514	45,072	47,897	20,162	15,872	—	—
Balsam poplar	434,789	5,946	17,566	6,081	31,938	120,829	119,527	83,124	37,167	12,611	—	—	—	—
Nonstocked	18,511	18,126	—	—	—	385	—	—	—	—	—	—	—	—
All types	10,620,750	211,269	150,707	236,770	1,075,974	2,293,694	2,452,002	1,392,802	1,241,874	410,828	682,431	245,655	217,226	9,518

[1]International ¼-inch rule.

Table 30.—*Net volume of short-log trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	563	—	—	152	79	—	86	—	246	—	—
Red pine	402	147	—	74	—	109	72	—	—	—	—
Jack pine	2,067	763	481	627	196	—	—	—	—	—	—
White spruce	117	117	—	—	—	—	—	—	—	—	—
Black spruce	421	255	—	—	166	—	—	—	—	—	—
Balsam fir	1,890	835	201	141	65	648	—	—	—	—	—
Tamarack	1,798	1,034	681	83	—	—	—	—	—	—	—
Northern white-cedar	4,140	1,547	1,368	366	384	254	92	41	88	—	—
Other softwoods	203	60	—	—	73	—	70	—	—	—	—
Total softwoods	11,601	4,758	2,731	1,443	963	1,011	320	41	334	—	—
Hardwoods:											
Select white oaks	2,442	—	855	610	446	256	—	275	—	—	—
Select red oaks	4,762	—	1,677	1,670	812	398	87	118	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	575	—	96	301	88	—	—	90	—	—	—
Hard maple	5,387	—	1,197	1,780	1,238	478	341	188	165	—	—
Soft maple	2,164	—	185	190	238	237	340	178	479	317	—
Ash	2,969	—	1,432	436	765	123	—	99	114	—	—
Balsam poplar	2,542	—	1,013	637	400	492	—	—	—	—	—
Paper birch	5,385	—	2,701	1,283	952	345	—	—	104	—	—
Bigtooth aspen	2,472	—	802	867	274	529	—	—	—	—	—
Quaking aspen	36,840	—	16,830	9,473	6,035	2,790	1,008	371	333	—	—
Basswood	2,976	—	961	570	594	337	342	172	—	—	—
Elm	5,431	—	1,432	684	704	504	628	421	592	466	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	73,945	—	29,181	18,501	12,546	6,489	2,746	1,912	1,787	783	—
All species	85,546	4,758	31,912	19,944	13,509	7,500	3,066	1,953	2,121	783	—

Table 31.—*Net volume of short-log trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	1,254	—	—	344	179	—	213	—	518	—	—
Red pine	1,039	442	—	169	—	254	174	—	—	—	—
Jack pine	5,962	2,494	1,517	1,508	443	—	—	—	—	—	—
White spruce	754	754	—	—	—	—	—	—	—	—	—
Black spruce	813	595	—	—	218	—	—	—	—	—	—
Balsam fir	4,110	1,824	628	394	194	1,070	—	—	—	—	—
Tamarack	4,638	2,685	1,773	180	—	—	—	—	—	—	—
Northern white-cedar	11,597	5,313	3,489	855	690	575	180	95	400	—	—
Other softwoods	635	303	—	—	165	—	167	—	—	—	—
Total softwoods	30,802	14,410	7,407	3,450	1,889	1,899	734	95	918	—	—
Hardwoods:											
Select white oaks	8,944	—	3,600	2,097	1,301	1,083	—	863	—	—	—
Select red oaks	14,337	—	5,696	4,433	2,598	1,053	101	456	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	1,822	—	330	880	177	—	—	435	—	—	—
Hard maple	13,800	—	3,189	4,473	2,937	1,143	605	490	963	—	—
Soft maple	6,035	—	758	596	680	627	1,017	434	1,145	778	—
Ash	6,368	—	3,212	1,071	1,431	227	—	193	234	—	—
Balsam poplar	6,141	—	2,702	1,610	867	962	—	—	—	—	—
Paper birch	14,287	—	7,012	3,180	2,732	888	—	—	475	—	—
Bigtooth aspen	6,032	—	1,915	2,135	536	1,446	—	—	—	—	—
Quaking aspen	93,367	—	41,508	23,665	15,570	7,404	2,847	1,173	1,200	—	—
Basswood	7,226	—	2,317	1,368	1,446	859	703	533	—	—	—
Elm	17,996	—	5,910	2,533	2,387	1,845	1,509	1,088	1,572	1,152	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	196,355	—	78,149	48,041	32,662	17,537	6,782	5,665	5,589	1,930	—
All species	227,157	14,410	85,556	51,491	34,551	19,436	7,516	5,760	6,507	1,930	—

[1]International ¼-inch rule.

Table 32.—*Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Northern Pine Unit, Minnesota, 1961 and 1976*
(In thousand cubic feet)

Species	[1]1961	1976
Softwoods	36,286	59,123
Hardwoods	107,007	100,669
All species	143,293	159,792

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 33.—*Net annual growth of growing stock on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	2,779	161	113	554	817	214	128	139	642	2	3	—	6
Red pine	8,742	59	234	1,358	2,311	328	467	679	2,889	180	1	—	236
Jack pine	19,216	134	849	2,156	3,687	299	2,086	3,488	2,547	1,470	39	888	1,573
White spruce	3,228	252	170	580	265	96	77	141	1,202	215	1	301	–72
Black spruce	4,947	448	104	882	321	153	15	116	1,918	739	4	237	10
Balsam fir	13,570	850	409	1,705	2,488	497	230	393	6,368	561	–6	224	–149
Tamarack	2,092	–210	–62	517	473	261	149	131	195	437	33	282	–114
Northern white-cedar	4,527	244	—	1,506	546	21	19	21	1,445	553	—	172	—
Other softwoods	22	10	—	—	4	—	—	—	8	—	—	—	—
Total softwoods	59,123	1,948	1,817	9,258	10,912	1,869	3,171	5,108	17,214	4,157	75	2,104	1,490
Hardwoods:													
Select white oaks	3,213	454	244	304	584	225	435	320	184	17	307	32	107
Select red oaks	6,034	427	662	191	1,515	274	1,439	747	529	—	155	—	95
Other red oaks	29	1	10	—	—	—	—	18	—	—	—	—	—
Hickory	12	7	—	—	—	—	5	—	—	—	—	—	—
Yellow birch	85	28	—	8	—	—	12	—	37	—	—	—	—
Hard maple	2,535	822	210	247	233	148	119	49	647	—	60	—	—
Soft maple	1,813	666	26	111	352	48	224	63	316	—	4	—	3
Ash	3,621	948	237	653	576	13	130	137	424	169	109	154	71
Balsam poplar	9,429	853	284	2,782	166	1,200	37	501	982	1,925	341	960	–602
Paper birch	15,829	1,238	1,053	1,680	3,333	895	1,627	1,330	4,015	369	25	63	201
Bigtooth aspen	341	133	–337	274	374	314	38	770	–587	43	—	—	–681
Quaking aspen	45,739	1,634	4,650	8,246	2,625	5,070	3,494	5,383	8,257	3,280	1,244	1,382	474
Basswood	6,228	1,262	614	773	703	487	277	268	1,263	13	548	5	15
Elm	5,617	398	590	1,145	815	939	153	148	745	100	473	50	61
Select hardwoods	73	9	26	—	3	—	29	2	—	—	4	—	—
Other hardwoods	71	5	24	8	2	5	—	—	4	—	9	2	12
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,669	8,885	8,293	16,422	11,281	9,618	8,019	9,736	16,816	5,916	3,279	2,648	–244
All species	159,792	10,833	10,110	25,680	22,193	11,487	11,190	14,844	34,030	10,073	3,354	4,752	1,246

Table 34.—*Net annual growth of sawtimber on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	14,775	786	424	2,559	5,113	1,101	484	541	3,722	16	—	—	29
Red pine	48,197	336	1,099	5,890	14,685	1,720	1,890	4,112	16,483	964	9	—	1,009
Jack pine	56,971	118	2,705	9,521	12,435	942	4,569	10,028	7,285	3,825	643	2,300	2,600
White spruce	12,764	1,467	598	2,747	1,084	365	128	470	5,439	508	24	309	–375
Black spruce	3,800	129	78	237	241	115	—	195	2,557	130	—	118	—
Balsam fir	36,542	3,139	682	2,940	6,668	1,670	1,133	729	17,357	1,579	17	1,028	–400
Tamarack	5,698	1,177	–1,157	738	1,095	577	267	188	1,730	782	138	163	—
Northern white-cedar	13,517	498	—	3,096	1,643	–10	—	67	5,382	2,479	—	362	—
Other softwoods	664	—	—	—	15	—	—	—	649	—	—	—	—
Total softwoods	192,928	7,650	4,429	27,728	42,979	6,480	8,471	16,330	60,604	10,283	831	4,280	2,863
Hardwoods:													
Select white oaks	9,585	440	2,688	745	2,430	1,128	575	344	304	55	684	62	130
Select red oaks	19,759	1,220	1,864	158	2,692	636	6,663	3,056	1,914	—	544	—	1,012
Other red oaks	3	—	2	—	—	—	—	1	—	—	—	—	—
Hickory	6	—	—	—	—	—	6	—	—	—	—	—	—
Yellow birch	166	39	—	7	—	—	43	—	77	—	—	—	—
Hard maple	6,239	2,780	497	854	215	187	513	30	1,115	—	48	—	—
Soft maple	3,278	1,801	6	776	131	74	432	27	31	—	—	—	—
Ash	5,340	–1,005	225	1,036	2,740	675	802	88	–60	533	131	85	90
Balsam poplar	25,742	2,898	1,159	7,009	2,050	2,464	27	487	4,928	3,555	499	1,108	–442
Paper birch	26,074	2,665	1,521	2,478	5,380	2,361	3,341	607	6,878	768	252	–177	—
Bigtooth aspen	10,651	658	942	1,209	3,288	1,228	2,289	1,964	–927	—	—	—	—
Quaking aspen	157,084	9,235	8,012	17,633	22,409	15,379	12,779	11,525	44,496	9,729	3,335	2,150	402
Basswood	12,042	3,300	1,325	1,667	1,737	796	268	82	2,120	68	615	14	50
Elm	18,524	2,838	513	3,229	1,785	4,032	198	79	3,647	280	1,757	27	139
Select hardwoods	444	420	—	—	—	—	24	—	—	—	—	—	—
Other hardwoods	287	7	23	18	224	—	—	—	—	—	15	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	295,224	27,296	18,777	36,819	45,081	28,960	27,960	18,290	64,523	14,988	7,880	3,269	1,381
All species	488,152	34,946	23,206	64,547	88,060	35,440	36,431	34,620	125,127	25,271	8,711	7,549	4,244

[1]International ¼-inch rule.

Table 35.—*Net annual growth of growing stock on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	2,779	1,025	—	420	-20	163	333	44	457	—	48	272	—	37
Red pine	8,742	3,361	158	499	14	953	1,379	674	1,105	—	119	480	—	—
Jack pine	19,216	1,433	409	542	307	3,133	3,346	2,506	4,390	—	837	2,313	—	—
White spruce	3,228	188	75	152	40	791	657	277	738	—	55	255	—	—
Black spruce	4,947	441	110	372	80	2,128	924	130	529	—	14	219	—	—
Balsam fir	13,570	4,548	29	405	104	2,317	2,504	459	1,950	—	148	1,095	—	11
Tamarack	2,092	212	9	356	37	892	583	65	-344	—	168	114	—	—
Northern white-cedar	4,527	758	123	866	38	1,639	302	104	450	—	—	247	—	—
Other softwoods	22	—	—	—	—	22	—	—	—	—	—	—	—	—
Total softwoods	59,123	11,966	913	3,612	600	12,038	10,028	4,259	9,275	—	1,389	4,995	—	48
Hardwoods:														
Select white oaks	3,213	178	2	197	24	217	491	39	1,432	—	76	553	—	4
Select red oaks	6,034	388	—	158	54	529	1,304	121	1,574	—	193	1,668	—	45
Other red oaks	29	—	—	—	—	3	16	—	10	—	—	—	—	—
Hickory	12	—	—	—	—	—	3	—	7	—	—	2	—	—
Yellow birch	85	—	—	—	—	7	18	10	10	—	10	30	—	—
Hard maple	2,535	83	—	144	31	541	245	104	563	—	213	606	—	5
Soft maple	1,813	76	—	45	-10	212	522	68	434	—	67	379	—	—
Ash	3,621	159	32	343	42	959	515	-159	650	—	151	929	—	—
Balsam poplar	9,429	227	201	1,344	428	2,590	1,101	-231	2,115	—	285	1,364	—	5
Paper birch	15,829	1,938	25	616	184	1,953	3,526	964	3,348	—	511	2,747	—	17
Bigtooth aspen	341	-1	7	69	13	782	-899	-564	309	—	169	449	—	7
Quaking aspen	45,739	5,288	411	2,584	306	10,192	6,685	430	11,883	—	1,164	6,782	—	14
Basswood	6,228	778	—	349	87	526	1,702	193	1,420	—	202	967	—	4
Elm	5,617	389	23	411	54	411	1,361	172	2,537	—	149	107	—	3
Select hardwoods	73	—	—	—	3	15	9	—	38	—	5	3	—	—
Other hardwoods	71	—	—	1	5	—	4	—	55	—	—	6	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,669	9,503	701	6,261	1,241	18,937	16,603	1,147	26,385	—	3,195	16,592	—	104
All species	159,792	21,469	1,614	9,873	1,841	30,975	26,631	5,406	35,660	—	4,584	21,587	—	152

Table 36.—*Net annual growth of sawtimber on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	14,775	6,388	—	1,716	–131	879	1,590	251	2,570	—	219	1,182	—	111
Red pine	48,197	18,918	932	3,157	99	4,228	8,680	2,395	6,265	—	478	3,045	—	—
Jack pine	56,971	7,045	1,903	53	88	9,883	10,488	4,417	15,312	—	257	7,525	—	—
White spruce	12,764	921	401	283	170	2,070	1,895	711	4,204	—	306	1,803	—	—
Black spruce	3,800	1,155	45	69	120	487	461	104	1,351	—	—	8	—	—
Balsam fir	36,542	13,652	49	215	155	5,961	5,745	1,165	5,579	—	–112	4,117	—	16
Tamarack	5,698	813	19	63	77	2,620	1,324	14	427	—	181	160	—	—
Northern white-cedar	13,517	4,300	105	1,044	76	5,012	793	1,040	431	—	—	716	—	—
Other softwoods	664	—	—	—	—	664	—	—	—	—	—	—	—	—
Total softwoods	192,928	53,192	3,454	6,600	654	31,804	30,976	10,097	36,139	—	1,329	18,556	—	127
Hardwoods:														
Select white oaks	9,585	699	8	215	66	350	1,413	6	5,540	—	101	1,187	—	—
Select red oaks	19,759	488	—	457	413	1,871	3,551	764	5,232	—	350	6,568	—	65
Other red oaks	3	—	—	—	—	—	1	—	2	—	—	—	—	—
Hickory	6	—	—	—	—	—	6	—	—	—	—	—	—	—
Yellow birch	166	—	—	—	—	5	44	24	7	—	25	61	—	—
Hard maple	6,239	—	—	704	40	1,121	572	611	2,085	—	61	1,045	—	—
Soft maple	3,278	5	—	8	9	567	418	20	1,216	—	46	989	—	—
Ash	5,340	1,021	35	274	20	3,269	1,175	–1,323	–1,081	—	152	1,798	—	—
Balsam poplar	25,742	1,606	711	2,522	86	6,151	6,248	515	6,416	—	406	1,053	—	28
Paper birch	26,074	3,930	5	1,411	658	1,678	4,178	2,182	6,711	—	338	4,983	—	—
Bigtooth aspen	10,651	1,533	—	811	13	2,344	–662	793	2,240	—	274	3,293	—	12
Quaking aspen	157,084	18,254	1,832	7,769	1,083	23,578	31,867	6,634	33,989	—	3,814	28,209	—	55
Basswood	12,042	2,433	—	1,002	132	393	2,518	225	2,550	—	272	2,502	—	15
Elm	18,524	1,613	56	1,223	150	314	5,127	692	7,157	—	319	1,873	—	—
Select hardwoods	444	—	—	—	2	—	—	—	410	—	14	18	—	—
Other hardwoods	287	—	—	4	23	—	—	—	36	—	—	224	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	295,224	31,582	2,647	16,400	2,695	41,641	56,456	11,143	72,510	—	6,172	53,803	—	175
All species	488,152	84,774	6,101	23,000	3,349	73,445	87,432	21,240	108,649	—	7,501	72,359	—	302

[1]International ¼-inch rule.

Table 37.—*Net annual growth of growing stock on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	2,779	58	892	644	43	17	2	1	30	39	11	112	673	249	8	—
Red pine	8,742	1,595	4,183	322	90	22	—	—	13	181	6	19	1,916	382	13	—
Jack pine	19,216	15,935	384	82	43	75	11	2	22	251	10	5	2,085	255	56	—
White spruce	3,228	148	91	45	284	346	35	27	36	–56	55	113	1,786	183	135	—
Black spruce	4,947	215	18	13	597	5	2,973	171	543	—	15	4	323	39	27	4
Balsam fir	13,570	108	454	49	2,964	76	166	33	93	25	173	623	6,824	1,127	654	201
Tamarack	2,092	5	6	—	–64	3	179	208	2,143	4	–221	13	–45	–167	21	7
Northern white-cedar	4,527	—	—	—	419	19	165	2,810	107	—	639	50	375	–126	66	3
Other softwoods	22	—	—	—	—	—	10	—	—	—	4	—	—	—	8	—
Total softwoods	59,123	18,064	6,028	1,155	4,376	563	3,541	3,252	2,987	444	692	939	13,937	1,942	988	215
Hardwoods:																
Select white oaks	3,213	30	8	5	18	1	—	—	—	793	98	286	1,764	173	37	—
Select red oaks	6,034	94	21	3	3	—	3	—	1	2,205	21	307	2,694	673	9	—
Other red oaks	29	—	—	—	—	—	—	—	—	1	—	1	26	1	—	—
Hickory	12	—	—	—	—	—	—	—	—	5	—	4	—	3	—	—
Yellow birch	85	—	—	—	—	—	—	—	—	—	15	51	5	14	—	—
Hard maple	2,535	—	—	3	—	—	—	—	—	41	174	1,616	530	141	30	—
Soft maple	1,813	4	3	2	16	—	3	—	6	133	112	399	939	190	6	—
Ash	3,621	2	6	—	138	—	7	71	13	53	1,504	764	916	71	76	—
Balsam poplar	9,429	33	36	4	107	29	11	85	110	36	242	419	2,231	195	5,975	–84
Paper birch	15,829	408	377	75	240	8	26	113	58	557	254	795	7,294	5,367	223	34
Bigtooth aspen	341	–576	–120	—	2	—	84	—	—	159	28	140	964	–346	6	—
Quaking aspen	45,739	620	286	32	328	80	128	–48	75	324	242	623	41,057	377	1,547	68
Basswood	6,228	5	—	11	25	—	—	—	—	368	237	3,686	1,549	343	4	—
Elm	5,617	8	3	—	46	—	6	1	43	138	630	1,900	2,027	505	310	—
Select hardwoods	73	—	—	—	—	—	—	—	—	29	—	11	26	7	—	—
Other hardwoods	71	12	4	—	—	—	—	—	—	4	5	31	15	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,669	640	624	135	923	118	268	222	306	4,846	3,562	11,033	62,037	7,714	8,223	18
All species	159,792	18,704	6,652	1,290	5,299	681	3,809	3,474	3,293	5,290	4,254	11,972	75,974	9,656	9,211	233

Table 38.—*Net annual growth of sawtimber on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	14,775	193	5,741	3,468	234	96	10	12	149	199	60	593	2,746	1,227	47	—
Red pine	48,197	6,091	25,750	1,591	459	52	—	—	61	558	—	106	11,372	2,094	63	—
Jack pine	56,971	41,494	590	107	137	181	22	2	38	322	—	8	13,527	517	26	—
White spruce	12,764	157	32	129	904	681	41	13	85	–365	736	336	8,293	682	1,040	—
Black spruce	3,800	102	—	26	1,201	23	850	–94	158	—	13	—	1,433	31	44	13
Balsam fir	36,542	86	1,500	53	6,008	599	525	363	87	14	–420	5,041	17,599	1,283	2,944	860
Tamarack	5,698	24	10	—	266	19	881	110	4,586	26	–708	25	381	–390	434	34
Northern white-cedar	13,517	—	—	—	2,488	55	834	4,066	801	—	2,810	142	2,338	–216	187	12
Other softwoods	664	—	—	—	—	—	—	—	—	—	15	—	—	—	649	—
Total softwoods	192,928	48,147	33,623	5,374	11,697	1,706	3,163	4,472	5,965	754	2,506	6,251	57,689	5,228	5,434	919
Hardwoods:																
Select white oaks	9,585	7	—	—	36	—	—	—	—	1,666	266	1,804	5,088	660	58	—
Select red oaks	19,759	37	43	—	—	—	—	—	5	5,352	7	1,795	9,702	2,798	20	—
Other red oaks	3	—	—	—	—	—	—	—	—	1	—	1	1	—	—	—
Hickory	6	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—
Yellow birch	166	—	—	—	—	—	—	—	—	—	33	119	7	7	—	—
Hard maple	6,239	—	—	17	—	—	—	—	—	15	32	4,377	1,295	491	12	—
Soft maple	3,278	—	—	—	19	—	9	—	—	29	358	461	2,321	81	—	—
Ash	5,340	—	—	—	30	—	—	40	—	27	1,845	1,431	314	681	972	—
Balsam poplar	25,742	42	—	—	877	14	—	115	130	29	595	1,288	5,940	2,290	14,422	—
Paper birch	26,074	1,058	1,597	16	–174	8	11	41	9	627	571	3,120	12,712	6,544	–73	7
Bigtooth aspen	10,651	26	5	—	—	—	7	—	—	307	51	1,337	8,641	277	—	—
Quaking aspen	157,084	65	135	–1,158	1,177	103	459	32	29	1,614	470	3,624	145,519	586	4,335	94
Basswood	12,042	—	—	25	52	—	—	—	—	395	1,133	7,451	1,997	945	44	—
Elm	18,524	13	—	—	96	—	—	3	29	424	4,797	5,490	6,466	569	637	—
Select hardwoods	444	—	—	—	—	—	—	—	—	425	—	2	17	—	—	—
Other hardwoods	287	—	—	—	—	—	—	—	—	—	11	276	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	295,224	1,248	1,780	–1,100	2,113	125	486	231	202	10,911	10,169	32,576	200,020	15,935	20,427	101
All species	488,152	49,395	35,403	4,274	13,810	1,831	3,649	4,703	6,167	11,665	12,675	38,827	257,709	21,163	25,861	1,020

[1]International ¼-inch rule.

Table 39.—*Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	18,704	93	11	2,447	5,378	4,910	3,744	1,854	231	—	36	—	—	—
Red pine	6,652	57	35	564	438	620	378	479	2,965	48	1,021	47	—	—
White pine	1,290	—	—	—	88	605	–5	152	146	67	37	200	—	—
Balsam fir	5,299	83	182	461	418	1,369	1,052	1,068	560	76	—	30	—	—
White spruce	681	—	16	76	—	—	416	124	—	49	—	—	—	—
Black spruce	3,809	60	109	293	505	477	738	461	219	703	107	40	97	—
Northern white-cedar	3,474	14	21	113	65	65	363	593	210	621	375	290	662	82
Tamarack	3,293	50	247	118	203	387	549	274	162	321	78	618	286	—
Oak	5,290	67	145	63	723	1,408	1,394	663	592	148	95	–8	—	—
Elm-ash-cottonwood	4,254	–152	150	118	283	802	690	219	181	1,028	560	156	219	—
Maple-basswood	11,972	–132	147	133	1,561	2,405	3,288	1,825	1,096	118	846	175	510	—
Aspen	75,974	–666	3,728	7,921	16,437	25,924	15,796	4,365	1,670	666	–13	85	61	—
Paper birch	9,656	52	132	260	935	3,486	2,088	1,871	619	–63	167	109	—	—
Balsam poplar	9,211	716	552	1,239	1,792	2,172	1,503	802	340	95	—	—	—	—
Nonstocked	233	225	—	—	—	8	—	—	—	—	—	—	—	—
All types	159,792	467	5,475	13,806	28,826	44,638	31,994	14,750	8,991	3,877	3,309	1,742	1,835	82

Table 40.—*Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	49,395	−572	700	1,823	13,999	19,955	7,982	4,400	1,046	—	62	—	—	—
Red pine	35,403	219	27	274	1,022	1,979	1,946	2,337	18,831	214	8,403	151	—	—
White pine	4,274	—	—	—	664	1,323	−480	617	516	231	196	1,207	—	—
Balsam fir	13,810	250	96	530	1,546	3,173	2,100	2,348	3,679	19	—	69	—	—
White spruce	1,831	—	—	48	—	—	696	923	—	164	—	—	—	—
Black spruce	3,649	50	43	77	348	734	1,746	270	91	211	13	66	—	—
Northern white-cedar	4,703	24	—	35	−213	−9	503	1,143	522	746	273	180	1,306	193
Tamarack	6,167	20	527	118	26	1,748	2,163	163	−509	1,056	138	536	181	—
Oak	11,665	14	231	33	1,460	2,029	3,993	2,250	1,900	554	57	−856	—	—
Elm-ash-cottonwood	12,675	−394	153	−291	209	2,119	836	−1,148	3,194	4,047	3,060	−19	909	—
Maple-basswood	38,827	112	619	88	3,678	4,704	11,277	6,562	5,914	168	3,166	847	1,692	—
Aspen	257,709	−484	7,265	16,030	41,980	100,050	70,640	10,082	7,013	4,392	508	103	130	—
Paper birch	21,163	62	3	147	−571	8,239	7,158	4,325	1,946	−1,123	739	238	—	—
Balsam poplar	25,861	262	179	162	2,610	9,457	6,807	5,138	893	353	—	—	—	—
Nonstocked	1,020	007	—	—	—	13	—	—	—	—	—	—	—	—
All types	488,152	570	9,843	19,074	66,758	155,514	117,367	39,410	45,036	11,032	16,615	2,522	4,218	193

[1]International ¼-inch rule.

Table 41.—*Timber removals from growing stock and sawtimber on commercial forest land by species, Northern Pine Unit, Minnesota, 1962 and 1976*

Species	Growing stock		Sawtimber	
	1962	1976	1962	1976
	Thousand cubic feet		*Thousand board feet*[1]	
Softwoods:				
White pine	1,368	1,013	7,643	5,026
Red pine	2,235	2,540	10,289	10,535
Jack pine	10,269	10,259	29,073	27,943
Spruce	4,818	4,723	10,473	10,493
Balsam fir	4,750	6,040	8,342	11,563
Tamarack	1,935	2,126	3,493	4,523
Northern white-cedar	993	1,801	1,268	3,568
Other softwoods	—	—	—	—
Total softwoods	26,368	28,502	70,581	73,651
Hardwoods:				
White oak	554	595	1,330	1,729
Red oak	1,178	1,988	2,554	4,597
Yellow birch	90	8	423	17
Hard maple	254	319	462	676
Soft maple	97	269	222	558
Ash	750	1,237	2,241	3,353
Paper birch	1,714	4,540	3,726	6,257
Aspen	20,982	32,642	41,066	82,174
Basswood	592	805	2,653	2,768
Elm	495	1,050	1,567	4,073
Other hardwoods	343	1,473	889	2,553
Total hardwoods	27,049	44,926	57,133	108,755
All species	53,417	73,428	127,714	182,406

[1]International ¼-inch rule.

Table 42.— *Timber removals from growing stock on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	1,013	60	82	233	162	23	14	37	361	16	12	—	13
Red pine	2,540	40	96	346	805	94	171	84	693	22	21	—	168
Jack pine	10,259	178	500	1,400	1,964	692	606	1,114	1,190	451	183	1,247	734
White Spruce	1,265	82	32	183	34	84	3	18	540	148	17	116	8
Black Spruce	3,458	112	16	525	80	268	—	23	1,213	834	3	381	3
Balsam Fir	6,040	284	121	1,137	344	209	38	38	3,642	123	21	76	7
Tamarack	2,126	345	18	403	90	523	26	84	449	45	22	113	8
Northern white-cedar	1,801	97	—	240	140	48	2	6	907	217	1	143	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	28,502	1,198	865	4,467	3,619	1,941	860	1,404	8,995	1,856	280	2,076	941
Hardwoods:													
Select white oak	595	44	62	33	93	61	59	23	52	6	131	10	21
Select red oak	1,980	595	136	70	374	77	214	87	275	5	87	8	52
Other red oak	8	1	6	—	—	—	—	1	—	—	—	—	—
Hickory	5	—	—	—	5	—	—						
Yellow birch	8	1	—	1	1	—	—	—	5	—	—	—	—
Hard maple	319	48	24	25	52	27	14	19	67	—	38	—	5
Soft maple	269	53	1	6	61	3	47	18	77	—	3	—	—
Ash	1,237	325	37	84	98	10	106	19	174	54	37	277	16
Balsam poplar	1,455	54	18	255	54	52	—	12	202	416	170	222	—
Paper birch	4,540	431	146	755	912	171	146	286	1,168	129	148	169	79
Quaking aspen	30,440	4,075	458	4,703	3,267	984	1,073	2,300	9,770	1,830	837	891	252
Basswood	805	90	83	192	43	18	75	6	87	1	170	15	25
Elm	1,050	84	98	96	41	110	46	7	282	27	113	106	40
Other hardwoods	13	—	1	—	1	—	—	5	—	—	1	4	1
Total hardwoods	44,926	5,987	1,145	6,384	5,465	1,599	2,016	3,134	12,769	2,490	1,735	1,702	500
All species	73,428	7,185	2,010	10,851	9,084	3,540	2,876	4,538	21,764	4,346	2,015	3,778	1,441

Table 43.—*Timber removals from sawtimber on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	5,026	302	416	1,156	824	92	69	208	1,738	92	62	—	67
Red pine	10,535	200	357	1,387	3,503	351	735	245	2,701	107	105	—	844
Jack pine	27,943	511	1,722	3,641	5,144	1,811	1,774	2,997	2,826	1,457	507	3,584	1,969
White Spruce	6,224	299	76	1,049	148	406	6	51	2,686	863	34	590	16
Black Spruce	4,269	75	20	470	81	370	—	38	1,414	1,289	2	508	2
Balsam Fir	11,563	438	162	2,370	741	383	53	69	6,963	210	27	120	27
Tamarack	4,523	731	35	866	184	1,145	55	178	943	97	41	238	10
Northern white-cedar	3,568	182	—	524	301	92	1	9	1,736	480	—	243	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	73,651	2,738	2,788	11,463	10,926	4,650	2,693	3,795	21,007	4,595	778	5,283	2,935
Hardwoods:													
Select white oak	1,729	141	242	67	210	279	257	41	80	13	283	22	94
Select red oak	4,587	946	534	181	772	216	893	126	442	8	270	12	187
Other red oak	10	—	9	—	—	—	—	1	—	—	—	—	—
Hickory	9	1	—	—	7	—	1	—	—	—	—	—	—
Yellow birch	17	2	—	2	3	—	—	—	10	—	—	—	—
Hard maple	676	129	73	51	78	60	49	27	102	—	83	—	24
Soft maple	558	169	1	8	84	4	118	26	144	—	4	—	—
Ash	3,353	1,341	122	184	148	12	516	26	509	65	45	330	55
Balsam poplar	2,522	93	30	491	91	89	1	20	393	649	288	376	1
Paper birch	6,257	657	216	722	1,248	233	339	298	1,982	137	160	163	102
Bigtooth aspen	5,473	768	146	440	1,110	167	614	389	1,826	13	—	—	—
Quaking aspen	76,701	10,674	1,097	10,558	8,137	2,650	3,056	5,458	27,126	3,678	1,581	1,766	920
Basswood	2,768	366	403	548	118	47	362	11	377	2	382	25	127
Elm	4,073	391	434	340	87	503	225	12	1,324	61	257	242	197
Other hardwoods	22	—	2	—	2	—	—	8	1	—	2	6	1
Total hardwoods	108,755	15,678	3,309	13,592	12,095	4,260	6,431	6,443	34,316	4,626	3,355	2,942	1,708
All species	182,406	18,416	6,097	25,055	23,021	8,910	9,124	10,238	55,323	9,221	4,133	8,225	4,643

[1]International ¼-inch rule.

Table 44.—*Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Northern Pine Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						Thousand board feet[1]					
Roundwood Products:												
Pulpwood	32,901	5,409	3,693	5,638	16,349	1,812	70,845	10,901	8,266	12,527	38,035	1,116
Saw logs	13,914	2,893	264	2,484	6,083	2,190	66,385	14,423	1,311	13,959	24,861	11,831
Fuelwood	3,519	282	—	39	743	2,455	4,916	392	—	66	1,034	3,424
Posts	721	365	—	330	16	10	366	155	—	139	34	38
Veneer logs	32	—	—	—	1	31	229	—	—	—	9	220
Poles	372	192	—	180	—	—	1,075	557	—	518	—	—
Other[2]	2,943	48	—	41	2,714	140	10,285	226	—	192	8,962	905
All products	54,402	9,189	3,957	8,712	25,906	6,638	154,101	26,654	9,577	27,401	72,935	17,534
Logging residue:	1,974	207	74	201	996	496	2,544	193	5	271	773	1,302
Other removals:	17,052	863	692	4,607	5,740	5,150	25,761	1,096	911	7,543	8,466	7,745
Total removals	73,428	10,259	4,723	13,520	32,642	12,284	182,406	27,943	10,493	35,215	82,174	26,581

[1]International ¼-inch rule.
[2]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 45.—*Timber removals from growing stock by ownership class and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National forest	5,790	1,883	3,907
Other federal	3,656	2,242	1,414
State	16,139	8,662	7,477
County	9,393	3,204	6,189
Forest industry	4,549	2,387	2,162
Farmer and miscellaneous private	33,901	10,124	23,777
All ownerships	73,428	28,502	44,926

Table 46.—*Timber removals from sawtimber by ownership class and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Ownership class	All species	Softwoods	Hardwoods
National forest	14,86	5,963	8,901
Other federal	9,11	5,566	3,553
State	43,66	24,429	19,239
County	25,49	8,853	16,643
Forest industry	11,02	5,293	5,733
Farmer and miscellaneous private	78,23	23,547	54,686
All ownerships	182,406	73,651	108,775

[1]International ¼-inch rule.

Table 47.—*Annual mortality of growing stock on commercial forest land by species and cause, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All causes	Cause										
		Insects	Disease	Fire	Animals	Weather	Supression	Logging	Timber stand improvement	Land clearing	Conversion	Unknown and other
Softwoods:												
White pine	256	—	217	39	—	—	—	—	—	—	—	—
Red pine	110	—	—	—	—	59	—	13	—	—	—	38
Jack pine	1,641	70	577	278	112	131	—	12	—	—	—	461
White spruce	149	—	4	—	26	105	—	—	—	—	—	14
Black spruce	461	—	144	—	50	103	—	—	—	—	—	164
Balsam fir	4,345	311	1,285	—	76	1,345	19	51	—	45	—	1,213
Tamarack	2,528	211	684	—	86	451	—	—	—	—	—	1,096
Northern white-cedar	528	—	231	—	—	84	—	—	—	—	—	213
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	10,018	592	3,142	317	350	2,278	19	76	—	45	—	3,199
Hardwoods:												
Select white oaks	327	—	327	—	—	—	—	—	—	—	—	—
Select red oaks	1,078	—	103	—	—	569	—	—	—	—	—	406
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	496	—	496	—	—	—	—	—	—	—	—	—
Soft maple	246	—	65	—	—	181	—	—	—	—	—	—
Ash	2,502	—	895	—	—	1,391	—	—	—	—	—	216
Balsam poplar	5,486	—	3,475	84	—	1,262	—	—	—	—	—	665
Paper birch	2,308	80	1,500	—	—	351	—	53	—	—	—	324
Bigtooth aspen	3,789	—	2,017	—	—	—	—	—	—	—	—	1,772
Quaking aspen	34,375	612	21,899	3,567	1,111	6,278	—	—	—	—	—	908
Basswood	723	—	232	—	—	272	—	104	—	—	—	115
Elm	1,184	—	634	—	—	—	—	7	—	—	—	543
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Non-commercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	52,514	692	31,643	3,651	1,111	10,304	—	164	—	—	—	4,949
All species	62,532	1,284	34,785	3,968	1,461	12,582	19	240	—	45	—	8,148

Table 48.—*Annual mortality of growing stock on commercial forest land by species and cause, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All causes	Cause										
		Insects	Disease	Fire	Animals	Weather	Supression	Logging	Timber stand improvement	Land clearing	Conversion	Unknown and other
Softwoods:												
White pine	1,287	—	1,049	238	—	—	—	—	—	—	—	—
Red pine	345	—	—	—	—	157	—	—	—	—	—	188
Jack pine	4,417	344	2,251	135	390	258	—	70	—	—	—	969
White spruce	541	—	—	—	60	481	—	—	—	—	—	—
Black spruce	209	—	51	—	—	58	—	—	—	—	—	100
Balsam fir	8,446	904	1,925	—	112	2,815	—	143	—	—	—	2,547
Tamarack	3,915	—	2,374	—	—	—	—	—	—	—	—	1,541
Northern white-cedar	1,596	—	872	—	—	205	—	—	—	—	—	519
Other softwood	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	20,756	1,248	8,522	373	562	3,974	—	213	—	—	—	5,864
Hardwoods:												
Select white oaks	—	—	—	—	—	—	—	—	—	—	—	—
Select red oaks	3,409	—	—	—	—	2,308	—	—	—	—	—	1,101
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	1,003	—	1,003	—	—	—	—	—	—	—	—	—
Soft maple	906	—	—	—	—	906	—	—	—	—	—	—
Ash	5,470	—	—	—	—	5,470	—	—	—	—	—	—
Balsam poplar	15,657	—	9,710	—	—	4,229	—	—	—	—	—	1,718
Paper birch	4,834	—	3,382	—	—	766	—	293	—	—	—	393
Bigtooth aspen	3,712	—	3,712	—	—	—	—	—	—	—	—	—
Quaking aspen	60,773	—	34,175	5,381	4,088	17,129	—	—	—	—	—	—
Basswood	1,790	—	885	—	—	905	—	—	—	—	—	—
Elm	3,151	—	3,151	—	—	—	—	—	—	—	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,705	—	56,018	5,381	4,088	31,713	—	293	—	—	—	3,212
All species	121,461	1,248	64,540	5,754	4,650	35,687	—	506	—	—	—	9,076

[1]International ¼-inch rule.

Table 49.—*Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National forest	4,623	620	4,003	7,796	1,498	6,298
Bureau of land mgmt.	—	—	—	—	—	—
Indian	3,343	563	2,780	7,303	1,994	5,309
Miscellaneous federal	221	78	143	875	388	487
State	9,231	2,592	6,639	19,405	3,163	16,242
County and municipal	18,956	1,907	17,049	32,781	3,712	29,069
Forest industry	4,883	420	4,463	7,994	536	7,458
Farmer	14,309	2,977	11,332	30,707	7,244	23,463
Farmer-owned leased	—	—	—	—	—	—
Misc. private-corp.	1,503	202	1,301	3,270	553	2,717
Misc. private-indiv.	5,463	659	4,804	11,330	1,668	9,662
Misc. priv.-corp., leased	—	—	—	—	—	—
Misc. priv.-ind., leased	—	—	—	—	—	—
All owners	62,532	10,018	52,514	121,461	20,756	100,705

[1]International ¼-inch rule.

Table 50.—*Output of timber products by source of material and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1975*

Product and species group	Standard unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*
Pulpwood:	Standard								
Softwood	cords[1]	206,222	16,287	186,641	14,740	11,092	876	8,489	671
Hardwood		307,562	24,296	229,899	18,161	31,584	2,495	46,079	3,640
Total		513,784	40,583	416,540	32,901	42,676	3,371	54,568	4,311
Fuelwood:	Standard								
Softwood	cords[1]	14,955	1,023	4,735	321	6,166	418	4,054	284
Hardwood		112,533	7,840	45,915	3,198	60,215	4,194	6,403	448
Total		127,488	8,863	50,650	3,519	66,381	14,612	10,457	732
Posts:	Thousand								
Softwood	pieces	1,062	851	867	695	195	156	—	—
Hardwood		59	34	45	26	14	8	—	—
Total		1,121	885	912	721	209	164	—	—
Veneer logs:	Thousand								
Softwood	board feet[2]	—	—	—	—	—	—	—	—
Hardwood		241	33	234	32	7	1	—	—
Total		241	33	234	32	7	1	—	—
Poles:	Pieces								
Softwood		63,212	377	62,374	372	838	5	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		63,212	377	62,374	372	838	5	—	—
Saw logs:	Thousand								
Softwood	board feet[2]	31,558	5,800	30,693	5,641	865	159	—	—
Hardwood		46,597	8,466	45,535	8,273	1,062	193	—	—
Total		78,155	14,266	76,228	13,914	1,927	352	—	—
Others[3]:	Thousand								
Softwood	cubic feet	230	230	89	89	—	—	141	141
Hardwood		3,307	3,307	2,854	2,854	298	298	155	155
Total		3,537	3,537	2,943	2,943	298	298	296	296
All products:	Thousand								
Softwood	cubic feet	24,568	24,568	21,858	21,858	1,614	1,614	1,096	1,096
Hardwood		43,976	43,976	32,544	32,544	7,189	7,189	4,243	4,243
Total		68,544	68,544	54,402	54,402	8,803	8,803	5,339	5,339

[1]Rough-wood, 128 cubic feet basis.
[2]International ¼-inch rule.
[3]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.—*Forest products harvested, by ownership class and product, Northern Pine Unit, Minnesota, 1975*

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*Thousand board feet*[2]	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
Federal:						
National forest:						
Softwoods	13,227	3,686	3,151	—	700	14
Hardwoods	26,235	1,703	32,516	—	—	605
Total	39,462	5,389	35,667	—	700	619
Other federal:						
Softwoods	20,986	1,827	115	99	4,700	2
Hardwoods	8,749	1,874	769	—	—	38
Total	29,735	3,701	884	99	4,700	40
State:						
Softwoods	75,105	11,839	684	340	12,465	23
Hardwoods	49,417	9,972	5,290	2	—	354
Total	24,522	21,811	5,974	342	12,465	377
County:						
Softwoods	26,145	4,171	661	32	—	10
Hardwoods	44,845	7,704	5,207	—	—	744
Total	70,990	11,875	5,868	32	—	754
Private:						
Forest industry:						
Softwoods	27,857	664	71	116	—	16
Hardwoods	20,448	2,670	427	—	—	109
Total	48,305	3,334	498	116	—	125
Farm and other:						
Softwoods	34,413	9,371	6,219	475	45,347	24
Hardwoods	111,789	22,674	61,921	57	—	1,335
Total	146,202	32,045	68,140	532	45,437	1,359
All owners:						
Softwoods	197,733	31,558	10,901	1,062	63,212	89
Hardwoods	261,483	46,597	106,130	59	—	3,185
Total	459,216	78,155	117,031	1,121	63,212	3,274

[1]Standard cords, rough wood, 128 cubic feet basis.
[2]International ¼-inch rule.

Table 52.— *Volume of primary plant residue, by kind of material and type of use, Northern Pine Unit, Minnesota, 1975*

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	470.7	1,651.5	414.7	1,487.4	56.0	164.1	—	—
Industrial fuel	—	91.5	—	1.9	—	89.6	146.8	100.9
Domestic fuel	283.8	356.7	274.3	352.0	9.5	4.7	124.8	191.7
Charcoal	57.6	59.1	57.6	59.1	—	—	35.9	38.2
Miscellaneous[5]	83.0	95.8	26.9	28.3	56.1	67.5	12.5	73.3
Not used[6]	941.9	1,306.6	391.4	310.5	550.5	996.1	596.7	1,203.9
Total	1,837.0	3,561.2	1,164.9	2,239.2	672.1	1,322.0	916.7	1,608.0

[1]Suitable for chipping such as slabs, edging, veneer cores, etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Does not include bark disposal at pulpmills.
[4]For manufacture of pulp, hardboard or roofing felt.
[5]Livestock bedding, mulch, small dimension, and speciality items.
[6]Includes residue burned as waste.

Table 53.— *Timber products output from roundwood, by species and product, Northern Pine Unit, Minnesota, 1975*

Species	All products	Saw logs		Veneer logs		Pulpwood		Fuelwood		Poles		Posts		Other products
	Thousand cubic feet[1]	Thousand board feet[2]	Thousand cubic feet[1]	Thousand board feet[2]	Thousand cubic feet[1]	Thousand cords	Thousand cubic feet[1]	Cords	Thousand cubic feet[1]	Pieces	Thousand cubic feet[1]	Thousand pieces	Thousand cubic feet[1]	Thousand cubic feet[1]
Softwoods:														
White pine	894	4,633	798	—	—	1,158	92	126	4	—	—	—	—	—
Red pine	2,137	8,333	1,435	—	—	4,014	316	336	17	30,472	182	191	152	35
Jack pine	10,161	15,671	3,009	—	—	73,505	5,804	9,305	654	32,740	195	559	451	48
Spruce	4,155	1,424	274	—	—	49,141	3,881	—	—	—	—	—	—	—
Balsam fir	3,737	955	181	—	—	44,845	3,543	252	13	—	—	—	—	—
Tamarack	2,073	70	13	—	—	25,070	1,980	840	51	—	—	39	29	—
Northern white-cedar	315	472	90	—	—	—	—	42	—	—	—	273	219	6
Total softwoods	23,472	31,558	5,800	—	—	197,733	15,616	10,901	739	63,212	377	1,062	851	89
Hardwoods:														
White oak	414	924	153	—	—	—	—	3,739	257	—	—	8	—	4
Red oak	2,447	2,567	428	38	5	5,816	460	21,547	1,508	—	—	14	6	40
Hickory	13	—	—	—	—	—	—	210	13	—	—	—	—	—
Yellow birch	14	—	—	6	1	3	—	210	13	—	—	—	—	—
Hard maple	405	210	34	29	4	159	11	5,075	356	—	—	—	—	—
Soft maple	341	256	45	15	2	19	—	4,201	294	—	—	—	—	—
Ash	754	2,424	424	1	—	55	5	4,671	321	—	—	11	4	—
Balsam poplar	138	196	33	—	—	917	73	559	32	—	—	—	—	—
Paper birch	4,607	1,615	282	105	16	18,225	1,440	39,947	2,794	—	—	—	—	75
Aspen	29,607	33,435	6,193	10	1	236,246	18,665	24,601	1,723	—	—	26	24	3,001
Basswood	364	1,828	321	31	4	—	—	181	7	—	—	—	—	32
Elm	629	3,142	553	6	—	41	2	1,147	74	—	—	—	—	—
Other hardwoods	—	—	—	—	—	2	—	42	—	—	—	—	—	—
Total hardwoods	39,733	46,597	8,466	241	33	261,483	20,656	106,130	7,392	—	—	59	34	3,152
All species	63,205	78,155	14,266	241	33	459,216	36,272	117,031	8,131	63,212	377	1,121	885	3,241

[1]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.
[2]International ¼-inch rule.

Table 54.—*Sampling errors*[1] *for estimates smaller than Unit totals of volume, net growth, and removals and of area of commercial forest land in Minnesota's Northern Pine Unit, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	*Thousand acres*	*Million cubic feet*			*Million board feet*		
1	2,722.5	9,859.6	518.4	2,093.0	91,776.4	4,243.6	3,372.6
2	680.6	2,464.9	129.6	523.3	22,944.1	1,060.9	843.1
3	302.5	1,096.2	57.6	232.6	10,195.3	472.0	374.7
4	170.6	616.2	32.4	130.8	5,736.0	265.2	210.8
5	108.9	394.4	20.7	83.7	3,671.1	169.7	134.9
10	27.2	98.6	5.2	20.9	917.8	42.4	33.7
15	12.1	43.7	2.3	9.3	408.3	18.8	15.0
20	6.9	24.7	1.3	5.2	229.4	10.6	8.4
25	4.4	15.9	0.8	3.3	146.7	6.7	5.4
50	1.1	4.0	0.2	0.8	36.9	1.7	1.3
100	0.3	1.0	0.1	0.2	9.2	0.4	0.3

[1]At the 68 percent probability level.

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OXFORD: 905(776). KEY WORDS: timber volume, growth, utilization, forest areas.

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